# THE TEXTILE MANUFACTURER

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# *Notes of the Month*

## PATENT PROTECTION IN THE SOVIET UNION

THE Comptroller-General of Patents has issued a statement concerning the protection of inventions in the Soviet Union. A U.K. delegation recently visited the country to discuss the protection available in the U.S.S.R. for U.K. inventions. The delegation, which consisted of Mr. G. Grant, Comptroller-General of Patents, Mr. W. Wallace, assistant comptroller of the Industrial Property Department, and Mr. H. R. Mathys, a Fellow of the Chartered Institute of Patent Agents and a director of Courtaulds Ltd., had most of its discussions with the Committee on Inventions and Discoveries under the Council of Ministers of the U.S.S.R. It also had talks with the All-Union Chamber of Commerce in Moscow which acts as an intermediary between the foreign owner of an invention and the committee in the grant of Russian patents and, after grant, notifies the patentee of any interest shown in the Soviet Union in the use of his invention, and with the Ministry of Foreign Trade which has a general responsibility for the licensing in the Soviet Union, of foreign-owned patents.

An inventor, Russian or foreign has by Soviet law, the option to seek either a patent, which gives him a monopoly in his invention which no one may then use without his permission, or an "author's certificate." In the latter case he assigns his invention to the State which remunerates him according to the amount of use made of his invention and the resultant saving to the economy. Since the latter system involves the inventor in less expense and fits much more aptly into an economic system in which all the means of production are controlled by the State, Soviet inventors invariably seek authors' certificates rather than patents. Foreign owners of inventions on the other hand tend to seek patents.

The new Soviet law of April, 1959, so far as it concerns patents, does not differ in essentials from the laws of the other countries. There is, of course, in the absence of contractual obligations, nothing to stop the copying of foreign inventions in the Soviet Union unless they are patented there. But the Soviet law, like those of other countries, provides the means whereby, if the necessary steps are taken, inventions can be protected. Before a patent is granted the invention must be described in a specification and a search is made through Soviet and foreign patents and technical literature to make sure that the invention is new. It must also have actual or potential "industrial utility," i.e. it must be in a field which, in the opinion of the Soviet technical organisation, is one in which there is or is likely to be activity. This latter test finds no place in the U.K. system which demands instead that the invention be not "obvious." If the invention passes these tests a patent is granted and, provided renewal fees are paid each year, the patent lasts for fifteen years from the date of application. Subject to the powers reserved to the State to issue compulsory licences (on payment of remuneration to the patentee) "where an invention is of special importance to the State"—and there is something like this in the laws of most countries—it is an offence, during this period, to use the invention without the patentee's consent. The delegation was told that the patentee's monopoly embraces not only the right to prevent others from making goods incorporating the invention but also the right to prevent them from importing such goods.

If a Soviet factory wishes to use an invention the Soviet patent for which is owned by a foreigner, the latter is notified by the Chamber of Commerce. The actual contract is negotiated by the Soviet Ministry of Foreign Trade and one of the import-export corporations. The exact division of responsibility is not clear but there is no doubt that the overall responsibility rests with the Ministry. The delegation was told of examples of licences negotiated in this way. It is usually sought to make such licences subject to arbitration before the arbitration tribunals of the All-Union Chamber of Commerce in Moscow.

### WILLIAM HENRY SPURR

**We deeply regret to record the death on December 22 at his home "Chelmscote," Longhurst Lane, Mellor, of an esteemed and respected colleague, William Henry Spurr who, up to the time of his death at the age of 83, was chairman of Emmott and Co. Ltd., publishers of "Textile Manufacturer" and "Mechanical World." He had an unusual record of over 60 years' service with the company joining it, in the first place, as assistant secretary in the early years of its formation under the founder, the late W. T. Emmott. He later served successfully as secretary, manager, managing director, and for many years was permanent director and chairman. It was due to his hard work, penetrating foresight and tenacity of purpose over the years that the company and its journals were built up, soundly based, and well-known throughout the world. A man with definite ideas and ideals of his own he nevertheless readily appreciated those of others and encouraged initiative in his younger associates both in business and private life. He was well read and had cultivated an extensive knowledge of art and literature. A notable raconteur, he also had a remarkable memory, and clearly exhibited a passionate love of the countryside, and particularly the beauty spots of Cheshire and Derbyshire. A genial personality and gentle disposition made him many friends in the technical press and advertising circles. The company and the journals he worked so hard for are a tribute and a memorial to his untiring endeavours.**

On the question whether or not a patent (or authors' certificate) shall be granted, the Committee on Inventions and Discoveries has the final word. The committee has its own appeals procedures which, the delegation were told, include a right for the inventor to appear and be heard. Disputes as to the ownership of inventions are heard by the ordinary courts. If infringement of a patent is suspected the committee would, it seems, look into this. In addition the delegation was told, by the Ministry of Foreign Trade, that infringement actions can be brought before the ordinary courts. It seems reasonable to assume, however, that no such action has ever been brought.

The Soviet officials who received the delegation expressed themselves as anxious to avoid any misunderstanding. It was clear that the Soviet officials were interested in foreign patent practice and the delegation got the impression that, so far as the different economic systems permit, were tending to bring their law and practice into line with those followed elsewhere. They seemed interested in the International Convention and had evidently given a good deal of thought to it. The delegation stressed both the practical and presentational advantages of membership of the Convention and these seemed to be understood. No indication that Soviet membership in the near future was likely, was however given.

Little use has so far been made, by U.K. owners of inventions, of the Soviet patent system and there is therefore little practical experience. The language problem and the widely differing concepts of the rights to be enjoyed by the individual as against officials will no doubt lead to some problems. But it seems clear that, at the worst, the owners of worthwhile inventions who contemplate trading with the Russians can only lose the fees they pay and, from the assurance given to the delegation, may well have a good deal to gain if they patent these inventions in the Soviet Union. In the light of this it seems only reasonable that the Soviet system should be given a fair trial.

## QUARTERLY SURVEY OF TRADE IN MAN-MADE FIBRES

The quarterly survey of the Lancashire textile trade in man-made fibres sheds further light on the movement of stocks in the third quarter of the year, as illustrated in the following statement issued by the British Man-Made Fibres Federation. The information available regarding retail sales shows, contrary to expectations, that the general level of retail sales of clothing and fabric has remained about the same since the beginning of the year and this level was about 5% above that of the latter part of 1958. Both filament and spun fabrics of man-made fibres increased their shares slightly. Stock building by makers-up and distributors continued at the same rate as in the second quarter. To some extent this was offset by stock reductions in other sectors. Orders on hand increased substantially in all sectors, particularly on the staple side. A significant feature of the present position is that the figures reveal a tendency in all sections to order in excess of actual orders received. Although the level of activity in all sections of the industry has improved, this has been due to a revival of stock building rather than to increased retail sales. Some increase in the level of stocks may be necessary once surplus capacity in the industry is eliminated, and stock building by makers-up and distributors may be a reflection of this.

*Staple Fibre Section.*—Spinners' production, and retail sales plus exports at all stages, were both about 2 mn. lbs. higher than in the second quarter. There was no overall stock change, falls in spinners' stocks of yarn and weavers' and converters' stocks of fabric being offset by rises in weavers' stocks of yarn and makers-up or distributors' stocks of fabric and clothing. Weavers saw a substantial rise in their deliveries although not quite to the level of the first quarter of 1959. Their stocks decreased. Converters' deliveries fell slightly because lower exports of finished fabric more than offset the slight rise in retail sales. Their stocks fell by about 2½ mn. sq. yds. compared with a fall of 5½ mn. sq. yds. in the second quarter.

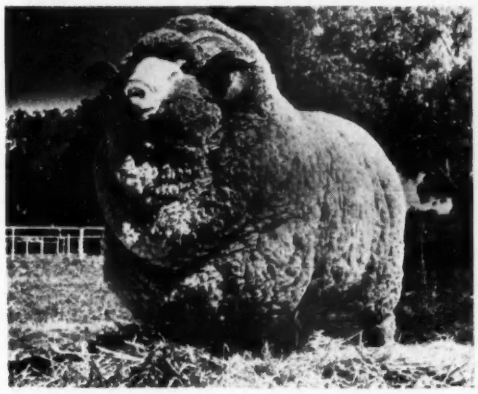
*Filament Section.*—Weavers' production rose by 6 mn. yds. Stocks as a whole within the industry rose by 4 mn. yds. Weavers' stocks did not vary a great deal following the fall in the second quarter. Converters' deliveries were the same as in the second quarter and they again reduced their stocks by about 4 mn. sq. yds. (*Two main points to note are that the statistics only refer to the major weaving section of our industry—the Lancashire textile trade, and that the figures are adjusted to eliminate purely seasonal influences.*)

## SCOTTISH TWEED DESIGNERS FORM GROUP

DESCRIBED as one of the most significant advances to be made by the Scottish tweed industry for many years, the formation of a Scottish Woollen Designers' Group was announced recently in Edinburgh. The objects of the group are to enable woollen cloth designers from all parts of Scotland to discuss among themselves art trends and ideas, to hear guest speakers of eminence in various forms of art and to widen the artistic horizons of the designers themselves. Mr. J. Derrick, of Peebles, who has been elected chairman of the group, said that designers had enthusiastically endorsed the idea which was bound to broaden the aesthetic outlook of its members. "It will also, inevitably, be of value to an industry of which the designers like to think they are a not unimportant part. Our members will welcome the opportunity to discuss common problems and I am certain that the industry and the designers themselves will benefit," he said.

Mr. J. Ballantyne (president, National Association of Scottish Woollen Manufacturers) said that while the idea had sprung from a suggestion he made to the Association earlier this year, the group was in no way a subsidiary of the Association. To emphasise its independence, membership was being restricted to practising and apprentice designers; managing directors of tweed firms who did some designing would not be eligible. "Pre-eminence in design is of paramount importance to the Scottish woollen industry," said Mr. Ballantyne. "New challengers are arising and Scottish designers must not only keep up with the times, but find that extra inspiration which confers supremacy. This is hard to achieve without the opportunity to exchange ideas and information, and we are naturally delighted that designers in the industry have combined to form this group."

Mr. D. Clive (International Wool Secretariat) who has taken an active part in the foundation of the group, said that while in the past Scottish woollen cloth had an assured, if small, market based on quality and design, today's customers were even more particular. Scottish designers must keep on their toes if the industry was to hold its own in an increasingly competitive world. The technical training available to Scottish designers and the high standards of design already attained were excellent; but there must be continual improvement. The formation of the Designers' Group would ensure that all the current influences in art, all the trends, thoughts and ideas about design, whether from Britain or beyond, would be available to its members. The group could play an enormously important part in heightening the Scottish woollen industry's already high reputation for good design.



(left) Fig. 1(a). Merino: A champion African ram

(right) Fig. 1(b). Cotswold: one of the last remaining flock left in Britain. (Photo by E. C. Peckham, F.I.B.P., Stroud)

# Wool: Properties, Uses and Future

*Complete in structure, wool fibres are circular or slightly oval, thicker at the root and tapering at the tip. The bulk of the fibre is made up of spindle-shaped cortical cells and wool; differs, therefore, from cotton in not being a single living cell but an aggregate of cells*

By J. W. S. HEARLE, M.A., PH.D., A.INST.P.*

TENDING sheep is one of the oldest occupations in the world and wool has long been the traditional fibre for warm clothing, blankets, and carpets. Primitive sheep—ancestors of today's flocks—were covered with long, coarse hair and soft light down nearest the skin. Skilful breeding and selection have developed this down into long wool with the coarse hairs practically eliminated from most sheep. Wool production, however, is not the only aim of sheep-farming. Meat production is equally important and the habitats of sheep range form bleak mountain tops to lush grasslands. Consequently, there are several important types of commercial importance, and typical specimens are shown in Fig. 1 (a to f). The finest wool comes from merinos—a breed that originated in the huge Spanish flocks. From 1400 to 1700 Spain jealously prevented export of this breed and throughout that period remained the source of the world's best wool. But since 1723, when they were exported to Sweden, merinos have spread to other countries and now from the largest part of the flocks in Australia, South Africa, the U.S.A. and Uruguay.

The chief mutton-producing breeds originated in Britain, either in the large, long-wool breeds such as Cheviot, Cotswold, Leicester, Lincoln, and Romney Marsh, or in the medium-wool breeds such as Southdown, Hampshire Down, and Suffolk. While these breeds still predominate in Britain, cross-breeds between the long-wool breeds and merinos are the commonest in such important meat-producing countries as New Zealand and Argentina. The most famous example is the Corriedale, developed from crosses between Lincoln rams and merino ewes. Another group of breeds provide sheep able to withstand hard, hilly conditions in which other types would not survive. The wool is coarser and mainly used for carpets. Typical

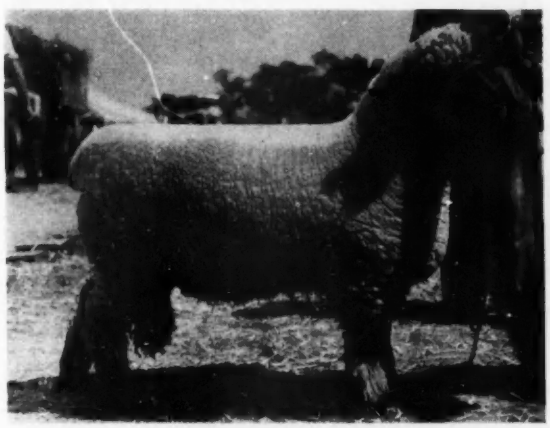


Fig. 1(c). Oxford Down: ram of the improved breed which has supplanted the Cotswold

* *Manchester College of Science and Technology*

Fig. 1(d). Corriedale: a champion New Zealand ram

examples are Blackface and Welsh mountain sheep. Another source of this coarse wool is the many varieties of little-improved breeds native to Asiatic countries.

The pattern of sheep-farming varies considerably. Wool may be obtained either as the "main crop" or as a by-product from the production of meat. The sizes of flocks range from a few sheep on a mixed farm, to 5,000 on a British hill-farm, or as many as 100,000 on a large sheep station in Australia (see Fig. 2). Some flocks are stationary; others are brought down from the hill-tops to sheltered valleys for the winter; and some trek hundreds of miles between hot plains and cool mountain pastures. Most sheep live entirely by grazing but some are fed on turnips, hay, or straw during the winter. On a mixed farm, the care of the sheep must be fitted in among many other jobs; but on the big sheep-stations all activity is centred around the annual schedule of mating, lambing, shearing, marking, and general care of the sheep. On these big stations in Australia, New Zealand, and South Africa, the supply of water largely determines the number of sheep which can be kept; but, everywhere, it is the skill and devotion of the shepherd which counts for most in achieving success.

## Supply of Wool to Industry

Most wool is supplied to the textile industry in the form of fleeces sheared annually from the sheep (Fig. 3a and b). These fleeces may contain between 25 and 80% of grease,

Fig. 1(e). Welsh mountain sheep

Fig. 1(f). Asiatic sheep from Himachal Pradesh, India

which must be removed by scouring—actually the first process in the wool textile industry. In addition, a small amount of very dirty wool is scoured in the producing countries in order to both reduce the weight and increase the value before it is exported. The second most important source is, of course, the wool from sheep which have been slaughtered or have died from other causes. This wool, which has to be removed from the skins by fellmongers, may be shipped either before or after removal from the skins. As with all natural products, assessment of quality is extremely important, and depends mainly on the skill of the buyer who inspects the fleeces on the show floor at the auction centres. Grading is based on three main factors (*a*) fineness, (*b*) length, and (*c*) estimated yield of clean wool. In addition, such subtle attributes of quality as colour, uniformity, softness, and absence of weakness must also be considered.

The fineness of wool is usually expressed in terms of what was originally the finest count* of yarn which could be spun from the wool. Over the years, however, the standards have changed, and the figures must now be regarded as an arbitrary scale. The main divisions are:—

(1) Merino—60s to 100s.
(2) Medium wools—46s to 60s, fine crossbred 56s to 60s *or* medium crossbred 50s to 56s.
(3) Long wools—36s to 50s, coarse crossbred 36s to 48s.
(4) Carpet wool—below 36s.

Table 1 shows the way in which the world's wool production is divided between the three groups of merino, crossbred and carpet wools.

Fig. 2. Sheep droving in Australia

* *Bradford quality groups are based on worsted count, i.e. the number of 560 yd. hanks per lb.*

Fig. 3(a). Sheep shearing shed in New Zealand

Wool lengths are usually grouped into three categories:—
(1) Carding or clothing—below 1½ ins.
(2) French combing—1½ to 2½ ins.
(3) Strictly combing—over 2½ ins.

The estimated yield of clean wool is expressed by the shrinkage.

## World Trade in Wool

Some wool is produced in almost all countries, but none of the six countries—Britain, U.S.A., France, Germany, Italy, and Japan—in the free world which consume most wool produce enough to satisfy their own needs. The difference is mainly met by the large surpluses produced for export in Australia, New Zealand, South Africa, and Argentina. There is thus a steady movement of wool from the vast open spaces of the Southern Hemisphere to the dense industrial populations of the North. The exceptions to this general movement are some smaller countries which produce enough for their own needs, and the world's

**Table 1**
**Production of Different Wool Types, 1957 -58**
**(million lb. p.a.)**

| | | |
|---|---|---|
| Estimated World Total .. | 5,051 | 2,894 |
| Merino .. .. .. | 1,965 | 1,058 |
| Crossbred .. .. | 1,940 | 1,263 |
| Carpet .. .. .. | 1,146 | 573 |

Fig. 3(b). Shorn sheep with fleece

**Table 2**
**Main Wool Exporting Countries**
**(million lb. p.a.)**

| Country | Production 1957-8 (greasy) | Home consumption, 1957 (clean) | Export 1957 (as exported) |
|---|---|---|---|
| Australia .. .. | 1,433 | 69 | 1,327 |
| New Zealand .. | 496 | — | 430 |
| Union of South Africa | 299 | — | 236 |
| Argentina .. .. | 409 | 77 | 194 |
| France† .. .. | * | * | 63 |
| Uruguay .. .. | 200 | 34 | 61 |
| India .. .. .. | 76 | — | 38 |
| Pakistan .. .. | 42 | — | 37 |
| Belgium‡ .. .. | * | * | 34 |
| United Kingdom .. | * | * | 29 |
| Chile .. .. .. | 46 | — | 22 |
| Eire .. .. .. | 18 | — | 16 |
| Iran .. .. .. | 43 | — | 15 |
| Syria .. .. .. | — | — | 14 |
| Iraq .. .. .. | 33 | — | 14 |
| Brazil .. .. .. | 65 | — | 9 |
| Morocco .. .. | 30 | — | 9 |
| Peru .. .. .. | 20 | — | 7 |
| Lebanon .. .. | — | — | 6 |
| Other countries .. (excluding Eastern Europe and China) | — | — | 75 |

* See Table 3.
† Mainly pulled wool from imported sheep-skins.
‡ Mainly re-exports of scoured wool.

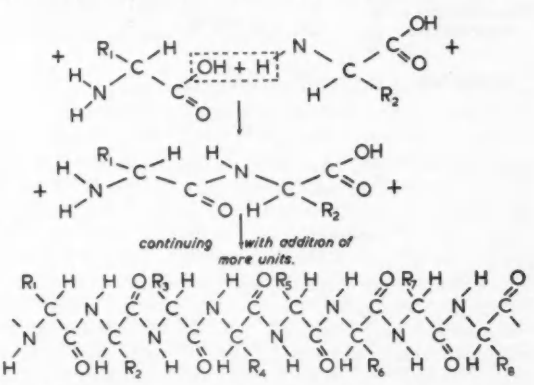



Fig. 6. Formation of a protein molecule from amino-acid units.

second largest producer, the Soviet Union, which only needs to import a little wool. Table 2 lists the main exporting countries, Table 3 the main consuming countries, and Table 4 other countries producing appreciable quantities of wool for their own use but do not play an important part in world trade.

## Constitution

The chief constituent of wool is a protein called keratin. Proteins are natural polymers formed, as illustrated in Fig. 4, by the linking together of amino-acid units in long chains. The essential physical features of an extended protein molecule are shown in Fig. 5; it is simply a long chain containing the moderately reactive—CO.NH—grouping, and having side-groups $R_1$, $R_2$, $R_3$, etc., sticking out. The diversity of proteins, which enables them to play such an important part in animal life, comes from the variety of side-groups, derived from different amino-acids, that can be incorporated in the chain. The specific function of any protein is determined by the selection and arrangement of the side-groups. Altogether about twenty different side-groups occur in nature and form an "alphabet" which can give a vast range of molecules with specific behaviours.

Table 5
Constitution of Keratin

| Amino-acid | Side-group | Percentage present |
|---|---|---|
| **Inert :** | | |
| glycine | —H | 6·5 |
| alanine | —$CH_3$ | 4·1 |
| valine | —$CH(CH_3)_2$ | 5·5 |
| leucine | —$CH_2CH(CH_3)_2$ | 9·7 |
| phenylalanine | —$CH_2C_6H_5$ | 1·6 |
| **Acidic :** | | |
| aspartic acid | —$CH_2COOH$ | 7·3 |
| glutamic acid | —$CH_2CH_2COOH$ | 16·0 |
| **Basic :** | | |
| lysine | —$(CH_2)_4NH_2$ | 2·5 |
| arginine | —$(CH_2)_3NH\ C(NH)NH_2$ | 8·6 |
| histidine | —$CH_2\ C : CH.NH.CH$ (N) | 0·7 |
| **Hydroxyl :** | | |
| serine | —$CH_2OH$ | 9·5 |
| threonine | —$CH(OH)CH_3$ | 6·6 |
| tyrosine | —$CH_2\ C_6\ H_4\ OH$ | 6·1 |
| **Ring-group :** | | |
| proline | —$CH_2$ / —$CH_2$ $WCH_2$ / W | 7·2 |
| **Double :** | | |
| cystine | —$CH_2$ –S–S– $CH_2$— | 11·8 |
| **Miscellaneous :** | | |
| methionine | —$CH_2\ CH_2\ S\ CH_3$ | 0·3 |
| tryptophan | —$CH_2$ . C⟨⟩ (CH — NH) | 0·7 |

aggregate of cells. In some coarse wools there is a medulla of air-filled cells at the centre of the fibre but this has been eliminated from the finer wools. Two features of great technical importance are (*a*) the scales on the surface and (*b*) the difference between opposite sides of the fibres. The scales point towards the tip, and prevent dirt and burrs penetrating through the fleece to irritate the sheep's skin. Technically, they account for the peculiar frictional properties which cause it to felt. Careful studies of the surface of the wool fibre under the microscope and the electron microscope reveal that it is composed of several layers. The main layer is composed of the cuticle cells that form the scales but, outside the cuticle, is a membrane called the epicuticle, and between the cutilce and the cortex lies another thin layer, the sub-cuticle membrane.

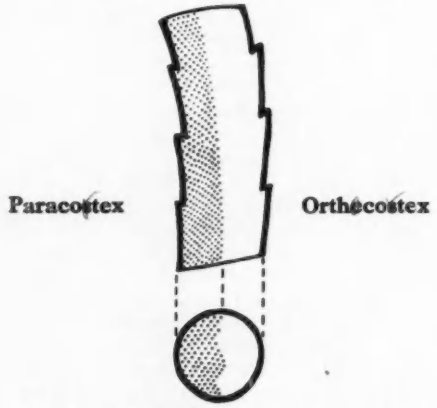



Fig. 8. Cross-sectional view and plan of wool fibre showing how fibre consists of a union of two semi-circular cylinders

Fig. 9. Wool classing

A wool fibre can be regarded as a union of two semi-circular cylinders, as shown in Fig. 8. The cells on one side are called the ortho-cortex, and those on the other side the para-cortex. The keratin in the para-cortex contains more cystine links between the separate protein chains, is more stable, and less accessible to dyes. The dividing line between the cells in the two regions is clearly visible in electron micrographs of wool fibres. The junction of the two halves rotates along the length of the fibre, so that each semi-circular cylinder is twisted into a helical path. Since the two parts react differently to changing conditions, swelling by different amounts, this causes the fibre as a whole to coil into a spirally crimped form, with the fibre bending in the same way as a bi-metallic strip when heated. The resulting crimp is one of wool's assets: since it is built into the structure, it is permanent, and even when temporarily pulled out, can always be recovered. Typical dimensions of wool fibres are given in Table 5.

### Variability of Wool

Wool fibres cover a great range of variability. There are differences between different breeds, different growing conditions, different fleeces from the same flock, different parts of a fleece, and between neighbouring fibres in a lock of wool. The selection for uniform quality—essential to the successful production of good fabrics—takes place in two stages. In the producing countries, the operation of

Fig. 10. Wool sorting in a Yorkshire mill

Table 3

Main Wool Importing Countries
(million lb. p.a.)

| Country | Imports (greasy) 1957 | Imports (clean equiv.) | Home production 1957-8 (greasy) | Consumption (clean) 1957 |
|---|---|---|---|---|
| United Kingdom | 604 | 397 | 299 | 481 |
| France .. .. | 437 | 280 | 56 | 299 |
| United States .. | 274 | 199 | 292 | 340 |
| Japan .. .. | 275 | 164 | — | 188 |
| W. Germany .. | 244 | 161 | — | 181 |
| Italy .. .. | 245 | 160 | 32 | 161 |
| Belgium .. .. | 155 | 88 | — | 80 |
| Soviet Union† .. | — | 73 | 635 | ‡ |
| Poland† .. .. | 42 | — | * | ‡ |
| Netherlands .. | 24 | 18 | — | 26 |
| Czechoslovakia† | 21 | — | * | ‡ |
| Canada .. .. | 20 | 15 | 8 | 20 |
| Austria .. .. | 17 | 13 | — | — |
| Switzerland .. | 16 | 11 | — | — |
| Sweden .. .. | 9 | 8 | — | 11 |
| Other Eastern† Europe and China | 15 | — | * | ‡ |

* Total East Europe production 136, China production 153.
† From free world.
‡ Consumption in Soviet Union, East Europe and China 627.

Table 4

Other Producing Countries
(million lb. p.a.)

| Country | Production greasy, 1957-8 |
|---|---|
| Spain .. .. .. .. | 81 |
| Turkey .. .. .. .. | 88 |
| Yugoslavia .. .. .. | 33 |
| Portugal .. .. .. .. | 25 |
| Greece .. .. .. .. | 24 |
| Other countries (not included in Tables 2, 3, 4) .. .. | 166 |

(Figures in Tables 1, 2, 3, 4 from "Industrial Fibres," 1959)

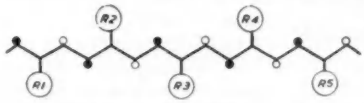


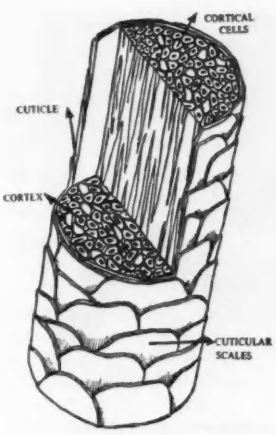

Fig. 5. Essential physical features of a protein molecule

The side-groups can be divided into several types:—

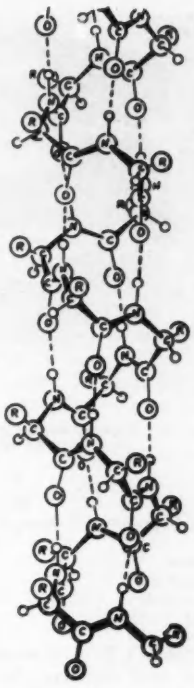
(1) Inert groups, such as —H and —$CH_3$.
(2) Acidic groups, such as —$CH_2$.COOH.
(3) Basic groups, such as —$(CH_2)_4$.$NH_2$.
(4) Hydroxyl groups, such as —$CH_2OH$ and $CH_2$⬡OH.
(5) A ring grouping, proline, $\begin{matrix}-CH_2\\-CH_2\end{matrix}\!\!>\!CH_2$ joining neighbouring carbon atoms in the main chain, thus reducing its flexibility.
(6) A double group, cystine, —$CH_2$.S.S.$CH_2$—which joins two neighbouring chains together.
(7) Other miscellaneous groups, such as —$(CH_2)_2$.S.$CH_3$ and —$CH_2$.C(=CH—NH)⬡.

Several of these side-groups will link together neighbouring chains, by different types of cross-link:—

(1) The hydroxyl groups will form hydrogen bonds, similar to those in cellulose.
(2) The acid and basic groups will form salts, held together by an electrostatic valency linkage, e.g. —$CH_2$.COO— + $H_3N(CH_2)_4$—.
(3) The cystine link joins neighbouring chains together into what is really a single network molecule.
(4) In addition, hydrogen bonds can form between the —CO.NH— groups in the main chain.




(above) Fig. 7. Diagrammatic representation of structure of non-medullated wool fibre (after Reumeth). Courtesy, W.I.R.A.



(right) Fig. 6. Fibrous protein molecular chain is shown coiled in the form of a helix

In Fig. 5 the protein molecule is shown as an extended chain but, in fact, in most proteins the chain is curled up, with different parts of the chain held together by some of the cross-links. In globular proteins, such as haemoglobin, the molecules are rolled into balls but in most fibrous proteins—such as keratin—the chain is normally coiled in a helix, as shown in Fig. 6. These long helically wound molecules can pack together into regular crystallites. The fine structure of wool, like that of other fibres, is thus a combination of long molecules passing through crystalline and non-crystalline regions (see Fig. 4, "T.M." June, page 258). The amount of crystalline material is not high, only about 20% of the total. Although there is less direct evidence it is around that the molecules are also coiled in the non-crystalline regions.

A complete analysis of the order in which side-groups are arranged in particular molecules has only been carried out for one or two simple substances, of which insulin was the first. However, there have been a number of investigations of the relative proportions of the different group, and Table 5 shows a typical result for keratin. The proportions are not always exactly the same; they will vary to a limited degree from one type of wool to another, from one fibre to another, and even between different parts of the same fibre. The word *keratin* is not, therefore, a definition of a particular chemical substance, but only of a number of very similar protein molecules occurring, naturally in hair, wool, and horn.

## Form of Wool Fibre

A model (Fig. 7) of a wool fibre reveals the complex features of its structure. Wool fibres are circular or slightly oval, thicker at the root, which is the growing part, and tapering at the tip. The tip, of course, appears only on wool from the first shearing. The bulk of the fibre is made up of spindle-shaped cortical cells and thus wool, therefore, differs from cotton in not being a single living cell but an

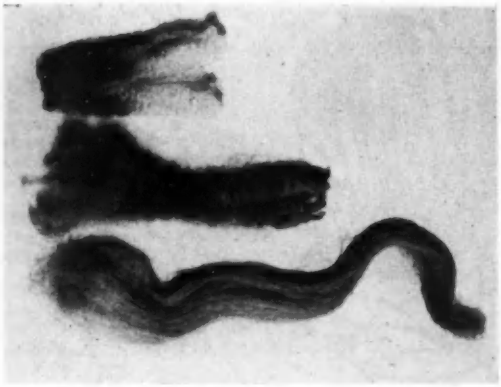


Fig. 11. Sample staples of (top to bottom)—(a) merino wool, (b) crossbred wool, (c) carpet wool

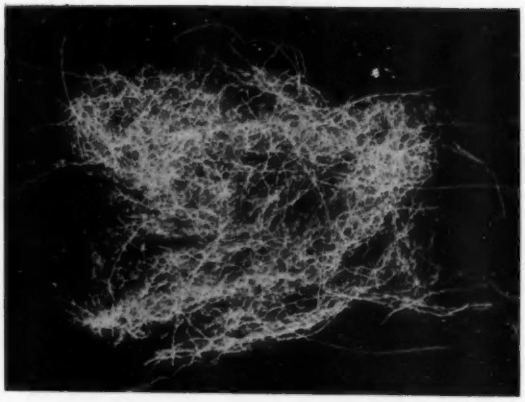


Fig. 12. Kemp fibres in a sample of coarse wool

Table 6
Dimensions of Wool Fibres

| Type | Range of diameters (microns) | Range of lengths (mm.) |
|---|---|---|
| Merinos .. .. | 18 – 27 | 55 – 75 |
| Crossbreds .. .. | 27 – 44 | 70 – 170 |
| Long wools .. | 20 – 60 | 125 – 350 |
| Carpet .. .. | 15 – 60 | 25 – 350 |

wool classing (Fig. 9) separates the fleeces into the separate classes, and removes the fringes of short wool and any blemished patches. In the mill, wool sorting (Fig. 10) separates the different parts of the fleeces into similar lots. In the medium and better qualities of wool, the whole fleece is composed of true wool fibres, Fig. 11(a) and (b); but in fleeces coming from sheep reared under primitive or hard conditions, there may still be appreciable amounts of the coarse, long, hair fibres, Fig. 11(c). These coarse fibres are in practice a useful component of carpet wools. A typical fleece might contain between 25 and 70% of true wool fibres, 16 - 25 $\mu$ dia., and 3 - 6 ins. long; 15 - 75% of coarse hair fibres, 25 - 40 $\mu$ dia., and 4 - 9 ins. long, called heterotypical because of their variation along the fibre length; and possibly some kemp (Fig. 12), which is dead fibre appearing as undesirable bright, straight hairs in the fleece.

## Properties

The properties of wool are summarised in Table 7. It is a highly moisture absorbing fibre, and this contributes to its comfort since sudden chills are prevented by the heat given out by the take-up of water on going from a warm, dry atmosphere to a cold, damp one. However, the main, factors contributing to the comfort of wool are its resilience and crimp, which give bulky warm fabrics. Typical load-extension curves for wool are shown in Fig. 13. Part of the characteristic handle of wool is due to its fairly high initial resistance to extension, followed by a much easier extension above the yield point. This gives it a crispness under small pressures but makes it soft and yielding when pressed harder.

The strength of wool is not high, but its great extensibility helps to give it a fairly high work of rupture, making it a durable fibre. In tests of wear and abrasion resistance, wool usually comes out better than cotton or rayon and is surpassed only by the tough synthetic fibres. Wool's durability is also assisted by its good recovery properties. Even when the fibres are stretched far beyond their yield-points, almost to breaking point, they still come back to near their original length on being released. This behaviour is somewhat exceptional, and is not shown by the regenerated protein fibres, which otherwise have a similar load-extension curve. In a carpet, wool's resilience causes it to spring back after each tread: the pile is not flattened, and the ware is taken on the tips of the fibres where it does least damage.

Table 7
Properties of Wool

| | 64s wool | 56s wool | 36s wool |
|---|---|---|---|
| Tenacity, g./tex .. .. | 11·5 | 14·3 | 11·6 |
| Breaking extension, % .. | 42·5 | 42·9 | 29·8 |
| Work of rupture, g./tex .. | 3·3 | 3·8 | 2·7 |
| Initial modulus, g./tex .. | 23·6 | 21·7 | 30·5 |
| Elastic recovery from : | | | |
| half breaking load .. | 0·70 | 0·77 | 0·86 |
| half breaking extension .. | 0·58 | 0·70 | 0·62 |
| (Wet strength/dry strength) × 100% .. .. .. | 76 – 97 | | |
| Density, gm./c.c. .. .. | 1·28 – 1·33 | | |
| Moisture regain at 65% R.H. .. .. .. | 17·0 | | |
| Refractive index : | | | |
| light vibration, ∥ axis .. | 1·556 | | |
| light vibration, ⊥ axis .. | 1·547 | | |
| Electrical resistance at 65% R.H. (ohm-g./cm.²) .. | $5 \times 10^8$ | | |
| Effect of sunlight, prolonged exposure .. .. | Less affected than cotton | | |
| Attack by moths .. .. | Attacked | | |
| Attack by mildew .. .. | More resistant than cotton | | |
| Effect of strong acids .. | Resistant to all except hot sulphuric acid | | |
| Effect of strong alkalies .. | Attacked | | |
| Effect of weak alkalies .. | Attacked, if hot | | |
| Effect of organic solvents .. | Resistant | | |

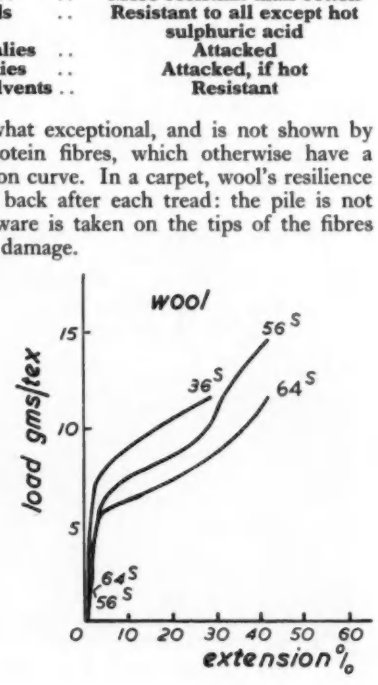



Fig. 13. Typical load-extension curves for wool

Wool's extensibility is a consequence of its molecular form. Ordinarily the molecules are coiled in the spiral form known as $\alpha$-keratin. Under low loads there is merely a slight, and strongly resisted, deformation of the structure; but under large loads, the coiled molecules open up into a fully extended chain of $\beta$-keratin. This transformation, from the coiled $\alpha$-keratin form to the extended $\beta$-keratin, which is like pulling out a coil spring until the wire is straight, occurs in both the crystalline and non-crystalline regions. It takes place easily once the load is above a certain value and gives great extensibility above the yield point. When the load is removed, the molecules coil up again, and the fibre recovers its original length.

The moisture absorbing behaviour of wool is interesting in that the first 8% of water, i.e., up to about 30% R.H., has little effect on such physical properties as torsional rigidity and electrical resistance. These properties are usually considerably influenced by moisture, but in wool, the first water molecules are firmly fixed to groups on the side-chains of the molecules and it is not until more water has been absorbed on to the main chains that the properties are affected. The electrical resistance of wool is fairly high—much higher than cotton or rayon—and so is more subject to static electricity with its consequent processing troubles. These can, however, be avoided by maintaining the humidity fairly high—above 50% R.H. is adequate for most purposes.

Pulled against the scales, wool fibres show a higher friction than when pulled in the opposite direction: some values of coefficients of friction are given in Table 8. This directional frictional effect in wool is essentially due to the ratchet-like action of the scales, although more subtle analyses have been developed to fit in with modern theories of friction. The effect is greater when the fibres are swollen; and consequently when wool is agitated in water, each fibre tends to move preferentially in one direction through the rest of the material, and the fibres become highly entangled. This is the process of felting, which is sometimes an asset, but is often a nuisance. Certain chemical treatments attack the scales, and reduce the directional frictional effect, as shown in Table 8—this reduces the tendency to felting and shrinkage.

Chemically wool is not particularly stable. It is attacked by alkalies and, untreated, is subject to serious damage by moths. Wool is not easily ignited so that it is a safe material and it is dyed without difficulty. The price of wool is fairly high, near to the prices of nylon, "Terylene," and acrylic fibres. More serious, the price is unsteady; for example, it rose to 231d. per lb. in 1950 - 51 during the Korean war, though it has now fallen to 100d. per lb. The range of prices is shown in Table 9.

**Table 8**
**Coefficients of Friction of Wool**

| | Against scales | With scales |
|---|---|---|
| **Dry merino** | 0·5 | 0·3 |
| **Wet merino** | 0·6 | 0·3 |
| **Chlorine treated wool, wet** | 0·1 | 0·1 |
| **Bromine treated wool, wet** | 0·25 | 0·2 |
| **Alcoholic caustic potash treated wool, wet** | 0·6 | 0·4 |
| **Sulphuryl chloride treated wool, wet** | 0·7 | 0·65 |

**Table 9**
**Wool Prices**
**(a) Prices of Combing Wools (d./lb.) in U.K.**

| Season | Merino 64s | Crossbred 50s |
|---|---|---|
| **1947-48** | 81 | 32½ |
| **1949-50** | 117 | 54 |
| **1950-51** | 231 | 152 |
| **1951-52** | 130 | 69 |
| **1953-54** | 140 | 78 |
| **1955-56** | 103 | 72 |
| **1957-58** | 104 | 69 |
| **June 1959** | 105 | 73 |

## Uses and Future of Wool

Wool's main use is in clothing and in such household goods as blankets, upholstery, and carpets. The amount consumed in different countries varies with the wealth and climate. The highest *per capita* consumption is in Australia, at 7·7 lbs. p.a. In western Europe, the average consumption is 3·5 lbs. p.a., Switzerland leading with 6·4 lbs. p.a. In Africa and Asia, consumption is only 0·2 lb. p.a. on the average. The industrial uses of wool are relatively few. The development and progress of synthetic fibres mean increasing competition for wool; typical examples are nylon socks and acrylic fibre sweaters. As the technology of the use of man-made fibres improves, the threat will be more serious. The cheaper end of the trade has certainly been affected the advances in rayon. Wool is thus in a vulnerable position, and price is the dominant factor. If the cost of wool rose seriously, even temporarily, large markets might be permanently lost to other fibres. *In this respect one can only regard Australian pleasure in higher wool prices as misguided in the long run in that the continued importance of wool could best be secured by maintaining a stable price level.*

Technically the development of wool must be concentrated on endowing it with the ease-of-care behaviour of man-made fibres. Moth-proofing, crease-resistance, permanent pleating, non-iron, drip-dry treatments and finishes are needed and must be achieved without losing wool's own character. To some extent, these advantages are achieved by blending wool with other fibres, e.g. wool/"Terylene" blends make an excellent material for shirts and slacks, and, in an age of haste, are not easily spoiled by careless use. The blending of other fibres with wool is certain to increase. To the modern fibre producer, the success of wool is an enigma. If a research chemist produced a new fibre with the properties of wool, its defects would damn it from the start. In the most obvious criteria of fibre evaluation—strength, ease of washing, heat-selling, dimensional stability, attack by common chemicals and living organisms—it would fail to make the grade. To some extent the widespread use of wool is due to tradition and the skill in its processing developed over hundreds of years. But it is also due to a combination of properties not yet adequately accounted for or measured. Resilience, bulk, and softness make wool a highly desirable fibre and fibre technologists can learn much from a study of its structure.

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**Suggestions for Further Reading**

**Wool: Its Chemistry and Physics, by P. Alexander and R. F. Hudson.**

**Wool—a booklet designed and produced by Barclays Bank.**

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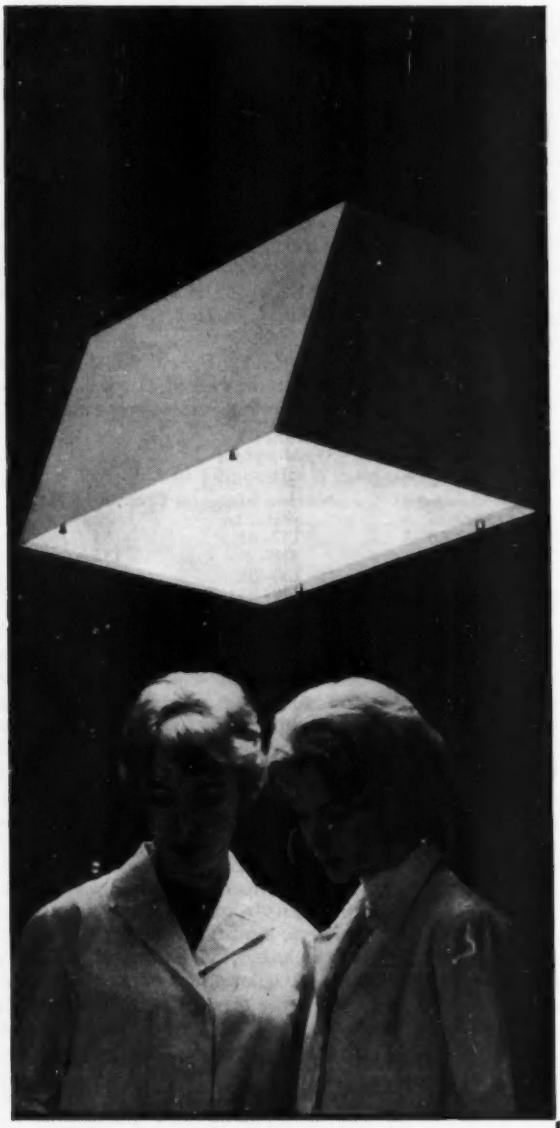
### Production of Man-Made Fibres

Encouraging figures of man-made fibres production were again recorded for November, according to an announcement by the British Man-Made Fibres Federation. The total of filament yarn and staple in November was 47.20 mn. lbs. which was slightly up on the October figure of 47·15 mn. lbs. and compared with only 37·57 mn. lbs. in November, 1958. The figure of filament yarn was 21·19 mn. lbs., compared with 21·75 mn. lbs. in October and 15.42 mn. lbs. in November, 1958. Staple production at 26·01 mn. lbs. in November compared with 25·40 mn. lbs. in October and 22·15 mn. lbs. in November, 1958. In the first eleven months of the year, the total of filament yarn and staple reached 463·10 mn. lbs., compared with 381·37 mn. lbs. in the similar period of 1958, and 460·04 mn. lbs.in the first eleven months of 1957, the record year.



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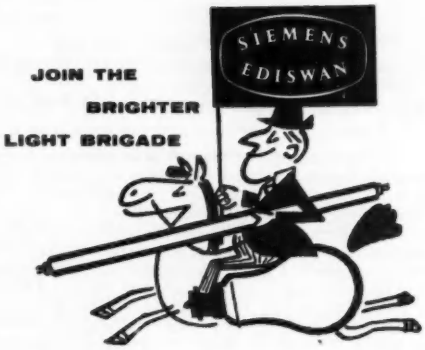


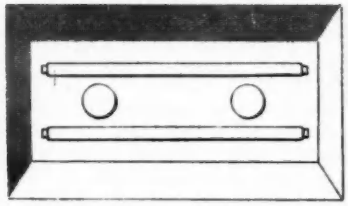

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# Assessment of Yarn Quality for Weaving*

*Observations on the various characteristics and properties of cotton yarns, also an outline of the rigourous tests and checks at every stage of production to ensure that quality is maintained and the customer gets what he wants*

By J. SLACK

TO assess the required quality of any material it is imperative to know everything possible about the proposed end-use. For instance, no one would dream of using mahogany for making a raft, or attempt to make bowls from balsa wood. The end product determines the type of material to be used, and fabrics are no exception to this rule.

The weaver, with a certain class of material and market in mind, has to provide the right construction and design to meet the demand or expected demand. The art of the designer, the ingenuity of management, and the possible scope of the loom are all utilised to achieve this object but yarn is also needed before the job can be done. Unfortunately, this very important item "yarn requirements" is all too often relegated to the bottom of the list and yarn selection is made—not on suitability for the job—but suitability of price.

There are, of course, exceptions. Some manufacturers stipulate a minimum breaking strength for the warp yarn and others will give the spinner some idea of the standards required in appearance and cleanliness. Weavers of high quality organdies are, perhaps, the best example. In the main they are fussy and critical but you can usually rely on them buying on a quality basis. As a salesman, I much prefer dealing with a buyer who is "bent" on buying the best yarn he can get—at a keen price if you like—because the one who buys purely on a price basis, often finds the yarn unsuitable when it gets into bulk production.

### Yarn Qualities

The qualities of a yarn are many and varied, including such characteristics as strength, levelness, cleanliness, elasticity, extensibility, plasticity, swellability smoothness, or hairiness, frictional properties, dielectric properties, absorption of liquids, feel, etc. These properties may, or may not, have any significant effect on the final fabric, but let us examine each in turn and see what the average spinner knows about them and, what is more important, see what he can do to control the properties.

*Strength and Levelness.*—Most spinners can quote chapter and verse about these factors and could, if required, spin to desired reasonable levels. The tools at his disposal are choice of material and layout of machinery.

*Cleanliness.*—Meaning absence of foreign material and nep in the yarn. This is not so easily defined but the spinner generally has some idea of his standards judged mainly by visual grading methods, with again a range of material, speeds and layout of machinery to help him achieve the desired standard.

*Elasticity and Extensibility.*—These are generally factors which the average mill manager knows little about, but he would, I am certain, be only too willing to co-operate with weavers to obtain correct results. Here, the tools at hand would be choice of material and adjustment of yarn twists.

*Plasticity.*—This may not be a required quality but—tongue in cheek—I would suggest that yarns with a high degree of plasticity would, all other things equal, be preferable to yarns with a low degree of plasticity for processes such as beetling.

*Swellability.*—Again, this is one of the factors spinners know little about but I would suggest this property can be enhanced or reduced by choice of material and the judicious use of twist variations in the yarn. My authority for this is the work carried out during the war years by Dr. Pierce at Shirley Institute in the manufacture of self-sealing waterproof canvas. Excellent results were achieved with low twist yarns with a fabric construction that permitted the yarns to swell on contact with water.

*Smoothness.*—This property demands that the fibres occupy parallelised positions in the yarn without protruding fibre ends. By intelligent use of fine fibres and high-class drafting systems the spinner can possibly go a long way towards achieving this result; but little is done about this yarn effect in a qualitative sense. Most spinners would be quite happy to achieve a good standard of levelness and would expect that this would also embrace smoothness, though they are not strictly comparable.

*Degrees of Hairiness.*—These are not measured by spinners, and it was worthy of special mention in a Manchester Chamber of Commerce Testing House Report a few years ago when their services were employed in testing two yarns for hairiness following a complaint made by a convertor about "barring" in a fabric which was caused by differential hairiness in some of the weft yarn. It would, in fact, have to be a fairly big change of yarn hairiness to attract the attention of spinners during any routine check of yarns. If hairiness was assessed as a necessary quality by the weaver then choice of fibre would be the spinner's standby and he would probably suggest that the weaver used a mule yarn rather than one spun on the ringframe.

*Frictional Properties.*—These are seldom examined and I would think that as in knitting where a low co-efficient of friction is required, a great deal can be done by employing oil-spraying in the mills and also if necessary by waxing or similar lubrication during preparatory weaving processes.

I am not sure what a spinner can do about providing yarns of certain dielectric standards but he could go part way at least by using some synthetic fibres with known dielectric properties also making sure the yarns were of a high standard of levelness. The degree of affinity for liquids is again more of a research laboratory technique than a normal mill routine test but if this function is important to weavers then careful use of cotton with a low natural wax content, or a judicious blend of fibres with an optimum amount of twist in the yarn could probably get us along the right lines.

*Feel of Yarns.*—This is a nebulous thing but it can have some relation to the amount of trash present in the yarn, the evenness of fibre, and perhaps wax content of the fibres, but it would be very difficult to arrange and keep to standards as this quality, possibly more than any other, is influenced by the human factor. I would like, here, to report on a test that we did in this connection at our mills. A certain manufacturer of mole-skin type fabrics was interested in our yarn and wished to check it against his standards. Samples of the yarn were woven on the same loom then judged for appearance, cleanliness and feel. Our yarn was, at least, as clean and satisfying in appearance as the standard yarn, but was judged to have an inferior feel to the standard yarn. The weaver had the utmost difficulty in translating to us what he meant by this difference in the feel of the cloth but more interesting to me, anyhow, was the little experiment tried by our Research Department. Certain members of the staff who knew the history of the case were given the fabrics and asked to judge them for feel. Most of them chose the fabric containing the standard weft. A sample piece of fabric was then submitted to them which had the standard weft in half of the fabric and our weft in the other half, the total length of the fabric being about one yard. The same people

* *From a paper given recently to Colne, Nelson and District Textile Managers' Association.*

who had examined the fabrics previously were then blindfolded and given the fabric to feel and handle on six consecutive occasions and on each test they had to decide which weft had the right feel. An analysis of the results showed the following :—

(1) No one present had given a unanimous verdict for either one of the yarns.
(2) There was a complete difference of opinion between individuals on the same fabrics.
(3) A summary of the results gave 26 points in favour of the standard yarns and 22 in favour of our weft. So, on the basis of these findings, I think you will agree with me that assessing a yarn for feel in fabrics presents, to say the very least, a rather tricky problem.

### Routine Control

Having more or less discussed the list of yarn properties, what conclusion can be drawn? Weavers can justifiably say that spinners are obviously lacking in knowledge of their own yarns. This may be so, but this is not the fault of the spinner alone. Surely, the weaver has also failed to make the spinner fully aware of the yarn properties that affect him as a weaver; that is, of course, assuming all the properties stated are of some importance. Broadly speaking the spinner tries to give the weaver the yarn he requires and he assesses his yarns from the reaction of the weaver.

In addition, for his own quality assessment, the spinner generally concentrates on strength, levelness, count variation, and cleanliness as his yardstick of performance, and I often wonder if he is wrong to do this. If it is necessary for the assessment of yarns to be extended, it is necessary to have a look at the list of yarn properties and see which can be incorporated into his routine checks and controls.

*Strength and Levelness.*—These are generally routine, except that strength tests are mainly carried out on leas of yarn and it could well be that insufficient attention is paid to single thread testing.

*Cleanliness.*—Most mills already have arbitrary visual standards.

*Elasticity and Extensibility.*—Extensibility could well be incorporated in the normal single thread test but elasticity would demand new laboratory equipment.

*Plasticity, Swellability and Smoothness.*—All these need new instruments and guidance from research laboratories.

*Hairiness.*—Would probably need a technique and instruments similar to the Shirley yarn diameter projector, or a gassing test would be required.

*Frictional Properties.*—Would entail routine tests with Shirley friction tester.

*Dielectric Properties.*—Tests for this can easily be carried out but new laboratory equipment would be needed.

*Absorption of Liquids or Wettability.*—This item does not present any special problem, but would require equipment and routine checks.

At this stage it may be worth mentioning that if these controls were put into operation in spinning mills it would also be necessary for the same instruments and techniques to be used in the weaving section and all work would have to be carried out on parallel lines. Weavers would be required to state the necessary standards and the spinner would have the job of achieving these levels. Such a condition would increase the tests required but would, I suggest, be beneficial for both sections of the trade and, in general, would tend to improve the qualities of our fabrics.

This naturally means co-operation between weaver and spinner, a state of affairs which has yet to be realised. In fact, in my capacity as a salesman it has often been necessary to enquire about the end use of our yarns. On making the enquiry, the general reaction is "That is no business of yours." How can anyone assess quality against this background?

Most spinners do make some attempt to control quality and keep up to standards but, unfortunately, can fall into real error in assessing yarn qualities for certain fabrics. There have been cases where customers have enquired about our best quality yarns and have automatically been put on to our dearest quality of combed Egyptian type. In one particular case, when the yarn was woven a complaint was made that the yarn was too slubby. In our language, as spinners, the best quality yarns means the strongest and cleanest but not necessarily the least slubby, in some cases the reverse is the case. I am quite sure that a cheaper mixing of cotton with block creeling would have been suggested to the customer if there had been complete confidence and co-operation between us.

In another instance, we were asked to produce a speciality yarn as a sample; initial trials were carried out on a few spindles and the yarn, when sampled, was found to be eminently satisfactory, so a small order was booked. When production was started it was found that various technical difficulties arose when spinning on a full frame and modifications had to be made to the original method of making the yarn, and the result from the spinning angle was very good. Unfortunately, the slight modification had altered the character of the yarn and it was not suitable for the customer. This is one example of where a little knowledge was a dangerous thing, and while our assessment of the yarn quality from the spinning angle was right, from the weaving angle it was completely wrong.

A simple example serves to illustrate what co-operation can achieve. A certain doubler was anxious to step up his quality, especially the folded yarn strength and extension. Knowing that strength and extension in the singles is not a reliable criterion for the folded yarn result, but is generally a function of the combination of folding twist and singles twist, we offered to collaborate with our friend to find the optimum combination for the best results. This he was only too pleased to do and we subsequently provided him with carefully prepared samples in a wide range of twists which he, in turn, doubled and tested. The result was, he achieved his object and completely revised his conception of twist requirements for this quality. Incidentally, our strongest single yarn was *not* the one that gave him the best results.

I often feel that far too much importance is attached by weavers to the relative strength of the single yarn because over a considerable range large differences in average single thread strengths have only a small effect on the warp breaking rate of a well-sized warp.

### Complaints

Our company pay a lot of attention to complaints (see Figs. 12 and 13) and a study of the information available enables me to make the following observations. Most of the complaints made are directly due to carelessness on somebody's part. General complaints about the yarn quality, i.e. strength, evenness, and cleanliness are rare, although individual complaints do occur from time to time. My pet hate is the irritating complaint received occasionally about mixed yarn, and strict controls are in operation in an effort to eliminate this type of thing.

There is, however, one kind of complaint that almost defies solution and with which most weavers are familiar; that is slubs of various sizes and shapes and thick ends. To tackle this particular complaint is far from easy because the causes are so many, but one possible line of attack would be the elimination of creelings, which create potential slubs, and that would be done by means of block creeling methods. This method, however, is wasteful and costly and would have to be fully discussed with the weavers.

I would like to give the numbers or possible numbers of potential slubs, taking the processing after the drawframes only, assuming that combing will eliminate any faults before the drawframes.

*Slubber.*—The creel piecing would account for 0.12 per lb. while the front piecings would account for 0.06 per lb.

*Intermediates.*—Creeling piecings would be 0.7 per lb. and front piecings 0.04 per lb.

*Jackframes.*—The creeling piecings would be 0.74 per lb. and the front piecings 0.15 per lb.

*On the Ringframe.*—Taking an average count, say, of 40s, creelings would account for 2.12 per lb. and front piecings 3 per lb.

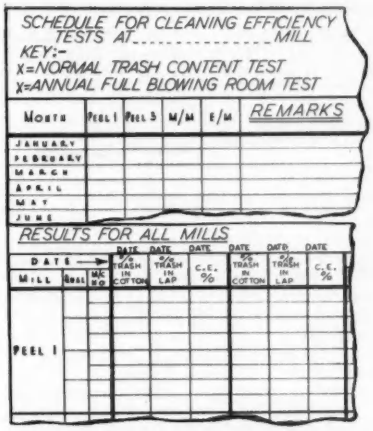
This gives a total of 3.68 creeling piecings and 3.25 front piecings per lb. of yarn and a final total of 6.93 per lb. Supposing that every piecing and creeling made a fault, and believe me, it is very difficult to avoid doing so, and let us assume that you were weaving a single poplin, say 120 reed and 60 pick. Using this 40s count for warp and weft in a 36-in. width, you would, in fact, get 140 faults in 100-yd. piece. In actual fact you would never get anything like this number because some piecings are so good as to be indiscernible, some are broken down at subsequent processes and some are taken out in winding. Nevertheless, they present a problem and one which makes the quality of yarn difficult to assess or measure.

Methods of eliminating these potential faults are varied but could possibly come under the following headings:—

(1) Block creeling to eliminate back creeling pieces.
(2) Short processing.
(3) Severe clearing.

Block creeling is wasteful, is costly and lowers overall production and, in any case, only deals with the creeling problem. Shortened processing on old machinery tends to reduce the yarn quality in other directions, e.g. lower strength and more irregularity in the yarn and it nearly always increases count variation. To replace with modern high draft machinery is an extremely costly job but probably well worth it, although possibly other features of yarn quality could suffer slightly.

Severe clearing is no solution at all and is rather a case of two wrongs trying to make a right. Mechanical clearers are far from 100% efficient and tend with very severe clearing to damage the yarn through scraping. There are, however, real possibilities in the electronic type clearer but these are also very expensive to install and require, I should imagine, a fair amount of supervision. Again, successful clearing


SCHEDULE FOR CLEANING EFFICIENCY TESTS AT..... MILL

KEY:-
X=NORMAL TRASH CONTENT TEST
X=ANNUAL FULL BLOWING ROOM TEST

| MONTH | PEEL 1 | PEEL 3 | M/M | E/M | REMARKS |
|---|---|---|---|---|---|
| JANUARY | | | | | |
| FEBRUARY | | | | | |
| MARCH | | | | | |
| APRIL | | | | | |
| MAY | | | | | |
| JUNE | | | | | |

RESULTS FOR ALL MILLS

| DATE → | | | DATE | DATE | DATE | DATE | DATE | DATE |
|---|---|---|---|---|---|---|---|---|
| MILL | QUAL. | MC. NO. | % TRASH IN COTTON | % TRASH IN LAP | C.E. % | % TRASH IN COTTON | % TRASH IN LAP | C.E. % |
| PEEL 1 | | | | | | | | |

**Fig. 1. Section of blowroom cleaning efficiency chart for four mills**

means the substitution of knots for the eliminated defects and is, therefore, not always acceptable. Generally speaking, I would prefer the modern short process layout to combat this type of defect and assessment could probably be carried out on a mathematical basis of creelings and piecings per lb. of yarn less the number extracted through winding.

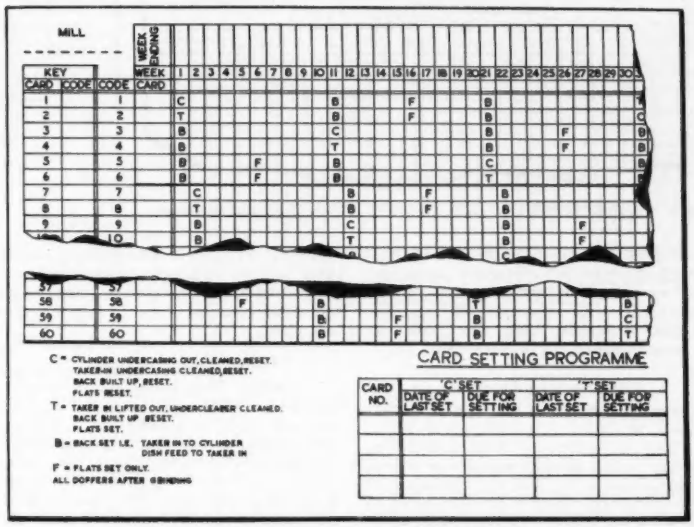
A lot of controls and checks are carried out in our organisation and these I will very briefly review.

### Cotton Room

The bales are keenly scrutinised by the mill staff and quickly rejected or put on one side if any bales are found with false pack, foreign material or mixed shades. It is extremely important to have thoroughly competent men in the cotton rooms and blowing rooms and they can only achieve the necessary qualifications if mill management is prepared to train them.

### Blow Room

There have been many experiments in the last few years to get the highest efficiency from present machinery. Mixings are laid down by the managing director and our production control department. A ticket is sent to the cardroom manager who arranges for the position of the bales and then the ticket goes on to the senior overlooker and the cardroom man. Each lap is weighed and rejected if outside the tolerances. Records are kept in the research department of the percentage of rejects and physical weights and percentage of blow room droppings. Approximately 5% of the laps are rejected weekly, also, there is a check on returned waste to the blow room. These tests are carried out on each quality in each mill every three months by the laboratory staff. Analyser tests are made on raw cotton samples and


MILL ---------

WEEK ENDING

| KEY CARD | KEY CODE | CODE | WEEK CARD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 1 | | C | | | | | | | | | | B | | | | | F | | | | | B | | | | | | | | | T |
| 2 | | 2 | | T | | | | | | | | | | B | | | | | F | | | | | B | | | | | | | | | C |
| 3 | | 3 | | B | | | | | | | | | | C | | | | | | | | | | B | | | | F | | | | | B |
| 4 | | 4 | | B | | | | | | | | | | T | | | | | | | | | | B | | | | F | | | | | B |
| 5 | | 5 | | B | | | | F | | | | | | B | | | | | | | | | | C | | | | | | | | | B |
| 6 | | 6 | | B | | | | F | | | | | | B | | | | | | | | | | T | | | | | | | | | F |
| 7 | | 7 | | | C | | | | | | | | | | B | | | | F | | | | | B | | | | | | | | | |
| 8 | | 8 | | | T | | | | | | | | | | B | | | | F | | | | | B | | | | | | | | | |
| 9 | | 9 | | | B | | | | | | | | | | C | | | | | | | | | B | | | | F | | | | | |
| 10 | | 10 | | | B | | | | | | | | | | T | | | | | | | | | B | | | | F | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | C | | | | | | | | | |
| 57 | | 57 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 58 | | 58 | | | | | | F | | | | | | B | | | | | | | | | | T | | | | | | | | | B |
| 59 | | 59 | | | | | | | | | | | | B | | | | F | | | | | | B | | | | | | | | | C |
| 60 | | 60 | | | | | | | | | | | | B | | | | F | | | | | | B | | | | | | | | | T |

C = CYLINDER UNDERCASING OUT, CLEANED, RESET.
TAKER-IN UNDERCASING CLEANED, RESET.
BACK BUILT UP, RESET.
FLATS RESET.

T = TAKER IN LIFTED OUT, UNDERCLEANER CLEANED.
BACK BUILT UP RESET.
FLATS SET.

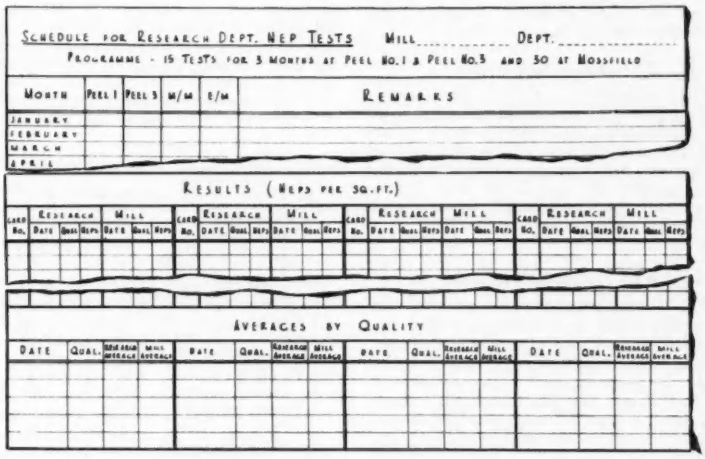
B = BACK SET I.E. TAKER IN TO CYLINDER
DISH FEED TO TAKER IN

F = FLATS SET ONLY.
ALL DOFFERS AFTER GRINDING

CARD SETTING PROGRAMME

| CARD NO. | 'C' SET | | 'T' SET | |
|---|---|---|---|---|
| | DATE OF LAST SET | DUE FOR SETTING | DATE OF LAST SET | DUE FOR SETTING |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Fig. 2. Top and lower part of card setting schedule**


SCHEDULE FOR RESEARCH DEPT. NEP TESTS MILL..... DEPT. .....

PROGRAMME - 15 TESTS FOR 3 MONTHS AT PEEL No.1 & PEEL No.3 AND 30 AT MOSSFIELD

| MONTH | PEEL 1 | PEEL 3 | M/M | E/M | REMARKS |
|---|---|---|---|---|---|
| JANUARY | | | | | |
| FEBRUARY | | | | | |
| MARCH | | | | | |
| APRIL | | | | | |

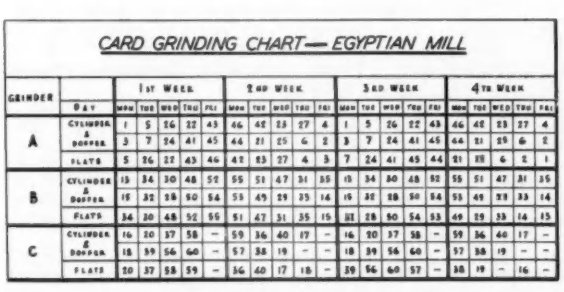
RESULTS (NEPS PER SQ.FT.)

| CARD No. | RESEARCH DATE | RESEARCH QUAL. | RESEARCH NEPS | MILL DATE | MILL QUAL. | MILL NEPS |
|---|---|---|---|---|---|---|
| | | | | | | |

AVERAGES BY QUALITY

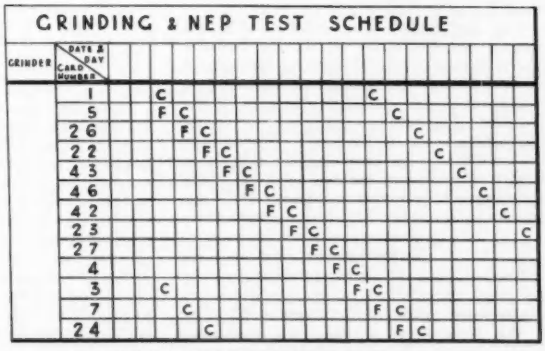
| DATE | QUAL. | RESEARCH AVERAGE | MILL AVERAGE |
|---|---|---|---|
| | | | |

**Fig. 5. Nep test chart from Research Department**


CARD GRINDING CHART — EGYPTIAN MILL

| GRINDER | | 1ST WEEK | | | | | 2ND WEEK | | | | | 3RD WEEK | | | | | 4TH WEEK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DAY | MON | TUE | WED | THU | FRI | MON | TUE | WED | THU | FRI | MON | TUE | WED | THU | FRI | MON | TUE | WED | THU | FRI |
| A | CYLINDER & DOFFER | 1 | 5 | 26 | 22 | 43 | 46 | 45 | 23 | 27 | 4 | 1 | 5 | 26 | 22 | 43 | 46 | 42 | 23 | 27 | 4 |
| | | 3 | 7 | 24 | 41 | 45 | 44 | 21 | 25 | 6 | 2 | 3 | 7 | 24 | 41 | 45 | 44 | 21 | 25 | 6 | 2 |
| | FLATS | 5 | 26 | 22 | 43 | 46 | 42 | 23 | 27 | 4 | 3 | 7 | 24 | 41 | 45 | 44 | 21 | 18 | 6 | 2 | 1 |
| B | CYLINDER & DOFFER | 13 | 34 | 30 | 48 | 52 | 55 | 51 | 47 | 31 | 35 | 13 | 34 | 30 | 48 | 52 | 55 | 51 | 47 | 31 | 35 |
| | | 15 | 32 | 28 | 50 | 54 | 53 | 49 | 29 | 33 | 14 | 15 | 32 | 28 | 50 | 54 | 53 | 49 | 29 | 33 | 14 |
| | FLATS | 36 | 20 | 48 | 52 | 56 | 51 | 47 | 31 | 35 | 15 | 11 | 28 | 50 | 54 | 53 | 49 | 29 | 33 | 14 | 15 |
| C | CYLINDER & DOFFER | 16 | 20 | 37 | 58 | – | 59 | 36 | 40 | 17 | – | 16 | 20 | 37 | 58 | – | 59 | 36 | 40 | 17 | – |
| | | 18 | 39 | 56 | 60 | – | 57 | 38 | 19 | – | – | 18 | 39 | 56 | 60 | – | 57 | 38 | 19 | – | – |
| | FLATS | 20 | 37 | 58 | 59 | – | 36 | 40 | 17 | 18 | – | 39 | 56 | 60 | 57 | – | 38 | 19 | – | 16 | – |

**Figs. 3 and 4. Card-grinding chart, also grinding and nep test schedule**


GRINDING & NEP TEST SCHEDULE

| GRINDER | DATE & DAY / CARD NUMBER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | | C | | | | | | | | | | | | | | C | | | | | | | | | | | | | | | | |
| | 5 | | | F | C | | | | | | | | | | | | | | C | | | | | | | | | | | | | | | |
| | 26 | | | | F | C | | | | | | | | | | | | | | C | | | | | | | | | | | | | | |
| | 22 | | | | | F | C | | | | | | | | | | | | | | C | | | | | | | | | | | | | |
| | 43 | | | | | | F | C | | | | | | | | | | | | | | C | | | | | | | | | | | | |
| | 46 | | | | | | | F | C | | | | | | | | | | | | | | C | | | | | | | | | | | |
| | 42 | | | | | | | | F | C | | | | | | | | | | | | | | C | | | | | | | | | | |
| | 23 | | | | | | | | | | F | C | | | | | | | | | | | | | | C | | | | | | | | |
| | 27 | | | | | | | | | | | | F | C | | | | | | | | | | | | | | | | | | | | |
| | 4 | | | | | | | | | | | | | | F | C | | | | | | | | | | | | | | | | | | |
| | 3 | | | C | | | | | | | | | | | | | F | C | | | | | | | | | | | | | | | | |
| | 7 | | | | C | | | | | | | | | | | | | | | | | | F | C | | | | | | | | | | |
| | 24 | | | | | C | | | | | | | | | | | | | | | | | | | F | C | | | | | | | | |

C CYLINDER & DOFFER GRINDING.
F. FLAT GRINDING.

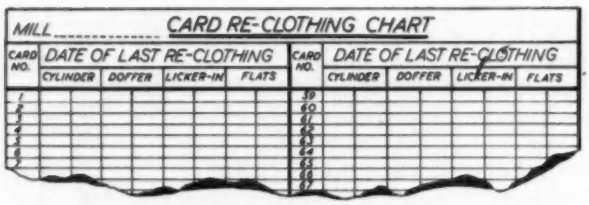



Fig. 6. Re-clothing chart for card, cylinders, doffers, flats and licker-ins

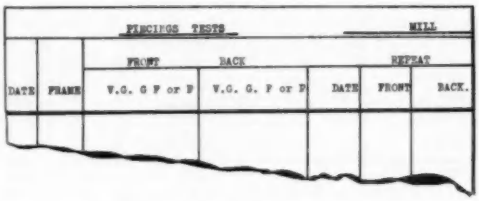



Fig. 7. Top part of chart for piecings tests

lap samples and the respective trash contents allow a cleaning efficiency percentage figure to be given on a report. These results are circulated to the mill manager, cardroom manager, and the mills for continuous records to be kept (Fig. 1).

### Card Setting Control

I have a number of the forms we use and (Fig. 2) is the one used in this instance, and I had perhaps better explain here that in giving details of the controls we run in our organisation it must be remembered that I am talking against a background of six mills with nearly 300,000 spindles so what we do doesn't necessarily apply to either larger or smaller units.

After a complete re-set a card test is taken, the waste extracted is sent to the laboratory for analysis and a report.

### Grinding Schedule

This programme is drawn up on results of long experience and collaboration with the inside staff. Nep tests are taken before and after each grinding of the cylinders and doffers and the average weekly results for each quality are calculated and shown. Frequently the Research Department staff take snap tests in each mill (Figs. 3, 4 and 5).

### Card Re-clothing Programme

This simply records the date when any particular card is re-clothed. This re-clothing programme covers the cylinder, doffer, licker-in or flats, or all four, and the cards are gone through systematically. A physical check on waste extraction is made and records kept. These show the weekly percentage flat strips and grid fly. The records are studied by the cardroom manager each week (Fig. 6).

### Ribbon Laps and Combers

The usual check on weight per yard is taken at least twice a week and only very few changes are made after many repeat wraps. A comber's function is basically to extract a pre-determined percentage of short fibres out of the raw cotton.

*Top Dressing.*—After setting, tests are carried out for waste extraction and the sliver is sent to the Research Department for levelness tests. Results are recorded on this sheet and a record is also kept in the Research Department for perusal by the mill and cardroom managers. These tests are carried out on each comber every two weeks. Continuous records are kept in the Research Department for perusal by the cardroom manager.

### Drawframes

Each finisher delivery is tested for weight per yard every three hours and necessary changes are made by the senior overlooker if the results are outside the statistical control limits. Levelness tests are carried out on each delivery every month and records are kept. The master record is kept in the Research Department and is inspected weekly by the cardroom manager so that he can take prompt action if required.

### Speed Frames

*Scouring Programme.*—On this form there is a column on the right "Reason for not scouring 3 in a fortnight." The actual programme is that one frame is done per grinder per fortnight, but in that particular mill a total of three per fortnight was the planned programme. If these targets are not attained reasons have to be given by the foreman fitter on that form and these forms are inspected by the cardroom manager weekly. After scouring, rovings which are produced off the machines are sent to the Research Department for levelness tests and again entries are made on the requisite form and prompt action taken if necessary.

CLEANING RECORD
FRAME No.
WEEK ENDING
CLEANER
OIL SADDLES, ROLLER NECKS AND ROLLER PIVOTS
GREASE CYLINDER BEARINGS ALTERNATIVE WEEKS
CLEAN HEADSTOCKS
CLEAN OUTER AND DRIVING ENDS
CLEAN FRAME FEET AND UNDERS
BRUSH SPINDLES AND PICK CATCHES
DOFFERS
OIL ROLLER ARBORS
CLEAN TOP ROLLER CLEARERS
BRUSH BACK IRONS
SPINNER OR ASST
BRUSH AND CLEAN CREELS
PICK ROLLER NECKS AND WIPE STANDS
BRUSH CREEL PEGS
BRUSH UNDER ROLLERS AND WEIGHTING
PICK UNDER APRONS
PICK & CLEAN WEIGHTED ROLLERS
PICK AND CLEAN ONE SIDE OF BACK ROLLERS TOP AND BOTTOM

Fig. 8. Section of a frame cleaning record

### Roving Creeling Control

Here we have a planned creeling cycle on the jackframes. When creeling commences a green ticket is put in the end bobbin of the sett and this ticket is visible on the cone of the bobbin. When creeling is completed a red ticket is put in the bobbin which in effect shows the end of the creeling period but, naturally, the mule spinner, to whom this control applies works in reverse and, when he gets hold of the roving, the red ticket will come up first, warning him that he is running into a sett of creeling pieces so that he can take extra care to watch and break down any faults that appear because of these creelings piecings. He continues to do this until he sees the green ticket appear when he knows that the tenter who produced these jack bobbins had passed the creeling period and from then on the bobbin is free of any piecings.

### Piecing Tests

Piecing tests are taken on all speed frames and on back and front piecings. Spot checks are taken by the supervisor and the piecings are taken right through and spun. They are followed through all the processes under the supervisor's watchful eye until the yarn is spun when the results are put on a drum and classified by the supervisor as very good, good, fair, or poor (Fig. 7).

Weekly tests for hank are taken at the full bobbin and piece on each frame. The results, presented graphically in a master copy covering all our mills, are kept by the cardroom manager. This is done in an effort to keep the average hank the same for each mill because when you are spinning rovings in the same quality but which are produced possibly in different cardrooms, you must sometimes mix the rovings from one cardroom and another and we pride ourselves that we can take a roving of any one quality produced in one of our cardrooms and spin it alongside other rovings taken from any other of our cardrooms and produce identical yarns.

### Cardroom General

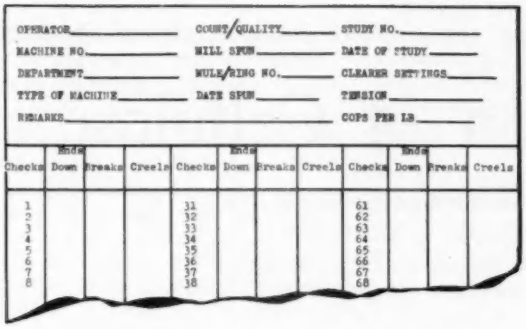
Weekly machinery inspection is carried out by the cardroom manager, senior overlooker and foreman fitter in each mill. Each section of cardroom is supervised by each member of the team in rotation and a memo. is sent to the appropriate fitter after inspection for quick action. There are also the usual vibration tests and we have a routine bobbin painting system which helps to avoid mixing rovings. All these comments may seem to be a long way from "assessment of yarn quality for weaving," but I feel sure they are very relevant to it, in that these controls do at least help us assess our own yarn quality standards.

### Spinning Department

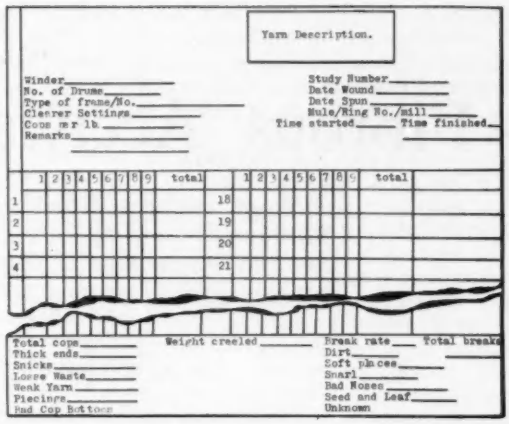
*Traveller Changes.*—Traveller changes are automatically made at regular specified intervals. Instructions are given and recorded by the Ring Room clerk when the change is completed. This aims at reducing the breakage rate.

*Top Clearer Stripping.*—This is a full-time job on the mechanical stripper for a day-time operative and front clearers are stripped twice a week. Back clearers are usually done by the evening shift labour. Again, this is recorded by the Ringframe clerk and this control makes an attempt to reduce bad ends.

*Scouring Programme.*—Two frames are scoured each week and it is done in overtime if necessary. This, again, is recorded by the overlooker (Fig. 8).




(Above) Fig. 9. Card for recording end breakage tests and rate




(Right) Fig. 10. Card for recording tests for faults in mule or ring spun yarns

*Pneumafil Bag Cleaning.*—The pneumafil is fitted to eliminate the un-spun roving wrapping round the front rollers. The bags which are placed over the fan outlet of the pneumafil system are emptied at the rate of two bags per day and are cleaned according to schedule, this is done to minimise the dirty fibre in the air.

*Sett Weights.*—Details given are ring number, counts and quality, builder and traveller, standard sett weight (based on a works study basis) and actual sett weight. If the actual weight is below standard then it is shown in red. These sett weight tickets are scrutinised by the overlooker and he checks on the builder, traveller and counts. If these are correct and yet the sett weight is below standard he has a word with the doffing mistress about doffing short.

*End Breakage.*—This is really a works study service and the results are entered in a file by the works study observer and the file kept in the ring room office. A separate sheet is maintained for each individual count and quality. Break tests are taken in the mill at the top and bottom of the tube and at all times these breaks are compared with standard (Fig. 9).

*Winding Room Breakage Rate.*—Rings and mules have this service in common. This is a works study service again and weekly reports which details mule or ring number, count and quality, and the date spun, the standard breaks per lb. and actual breaks per lb. This is studied, initialled and filed by the overlooker (Fig. 10).

*First Sett Tickets.*—The details on the tickets are quite clear and this control is run in an effort to get the first sett correct and up to standard. First setts have always been a convenient excuse for bad work. This should no longer apply here because each overlooker has a blackboard wrapping machine and can check the first sett at the beginning of the cop or ring tube and make immediate corrections if required (Fig. 11).

## Warehouse

The warehouse is responsible for count wrappings and also for wrapping the bottom of a cop after a change. The spinning overlooker is notified by ticket and changes are made according to limits. The number of cops or ring tubes used in these tests vary from count to count but we are pretty certain that an adequate number of cops or ring tubes are used. Graphs are kept for each mill or ringframe with change limits clearly indicated. All pinion changes are shown. All these details are examined daily by the spinning manager in an effort to minimise complaint of count variation.

*Snick Tests.*—These are taken regularly on the snick drum and are recorded in the snick book and it is one of the spinning manager's jobs to study this book every day in an effort to keep up a high standard.

*Strength Tests.*—These are taken on every sett as it comes off. The results are listed and sent to the Research Department for filing after they have been scrutinised and assessed against standard by the mill manager (Fig. 13).

*Moisture Gain.*—A weekly return is made of the packed and spinning weights and this return is sent to the Research Department for filing after being studied by the mill manager.

Raw cotton is chosen on the basis of separate reports from the broker and our Research Department and routine checks are carried out frequently on the stock. Standards of weight for laps, slivers, and

(*Continued on page* 548)

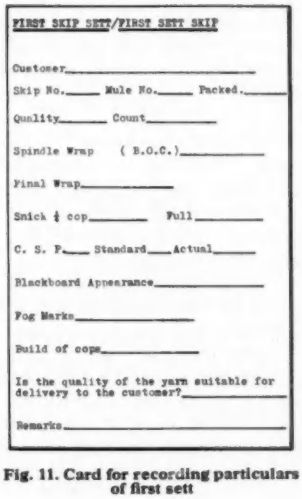



Fig. 11. Card for recording particulars of first sett

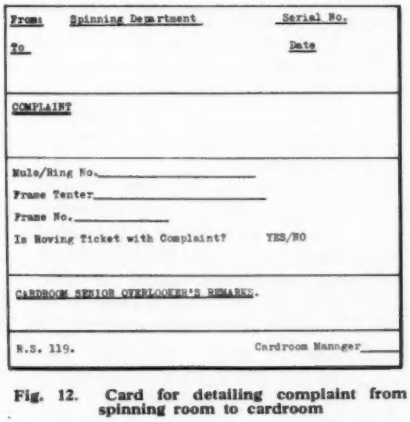



Fig. 12. Card for detailing complaint from spinning room to cardroom

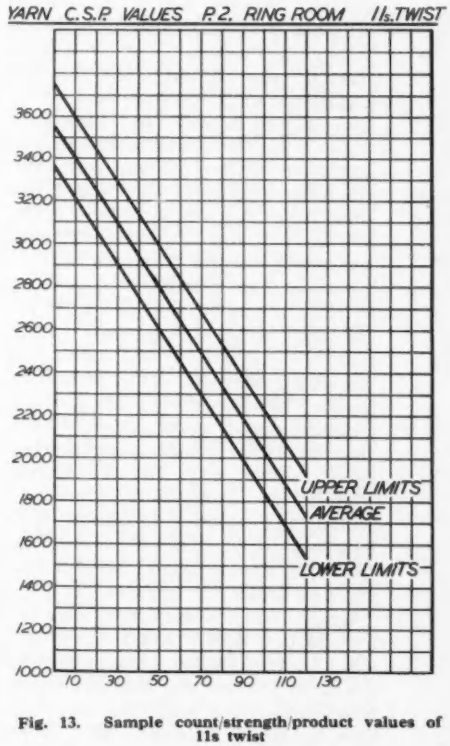



Fig. 13. Sample count/strength/product values of 11s twist

# Fibrous Acetylation of Cellulose

*Although complete details of the manufacturing process for a Japanese fibre—Alon—are not available, consideration of basic construction, mechanical properties and other features suggest it has considerable possibilities. Production at present is 3 to 4 million lbs. per annum*

By R. W. MONCRIEFF, B.Sc., F.R.I.C., F.T.I.

SOMETHING quite new has happened recently in the manufacture of cellulose acetate rayon. This is the production of a fibre which has been acetylated in fibrous form; the fibre comes from Japan and is known as Alon. It is astonishing that after having been made for 40 years on an enormous commercial scale, cellulose acetate should now be subject to a revolutionary change which completely eliminates the traditional methods of manufacture.

The manufacture of cellulose acetate has in the past undergone quite big changes in direction but all of the varieties that have been spun until very recently have been prepared by a solution process, i.e. a *solution* of cellulose acetate has been extruded through spinnerets. The first commercial manufacture of cellulose acetate was undertaken by the Lustron Company in America and from 1914 until 1924 they spun cellulose triacetate continuous filament yarn from chloroform solution; the output was small by today's standards, only about 300 lbs. per day, but the achievement was outstanding for the time. Secondary acetate was first made in quantity by the Dreyfus brothers as a dope for the fabric wings of aeroplanes during the 1914 - 18 war; at the end of the war the production of this secondary acetate was successfully converted into Celanese rayon; other companies introduced similar products under other new names, e.g. Seraceta and Rhodiaceta. Everything proceeded steadily and smoothly for tens of years and then round about 1955, cellulose triacetate was marketed once again, this time under the names of "Tricel," "Arnel" and "Courpleta"; its reintroduction after a period of 30 years since Lustron started spinning it, was due to an attempt to obtain in a rayon those ease-of-care features which had been so highly esteemed in "Terylene" and nylon fabrics. Triacetate would take a permanent pleat and it was a good deal cheaper than the true synthetics. But throughout its history, from its commercial introduction by Lustron in 1914 until about 1956, all cellulose acetate, whether triacetate or secondary, had been spun from a *solution* of cellulose acetate. It was the Japanese introduction of Alon which constituted a revolutionary change in that a *fibre* was acetylated without loss of fibre form.

## Reasons for Fibrous Acetylation

When a process has been run for 30 or 40 years it should be running very smoothly indeed and all the sources of error and of lack of uniformity should have become well understood and virtually eliminated. Such indeed was the case with the traditional method of spinning cellulose acetate; the product was good, it was uniform and well-liked. There must, therefore, be compelling reasons for throwing overboard all the well-known techniques of an established process and introducing an entirely new process. The reasons which might induce such a change to be made in the manufacturing method of cellulose acetate would at first sight appear to lie amongst the following:—

(1) If the raw material is fibrous it would seem wasteful to dissolve a fibre and then re-form it; it would seem more economic to retain the fibre form throughout the process.

(2) The new process might enable the use of the relatively expensive solvents such as acetone and methylene chloride which are ordinarily used in dry-spinning cellulose acetate to be avoided and to be replaced by that of water. In effect this second possible advantage would lie in the substitution of a cheaper process for the earlier more expensive one.

(3) The product made by the new process might have new and valuable properties that were not associated with the earlier types of cellulose acetate that have been made.

It may be of interest to examine these possibilities to see which advantages derive from the new method of manufacturing cellulose acetate that has been adopted in Japan, either from the standpoint of process or of product, and to assess their potentialities in the textile world generally.

## Traditional Loss of Fibrosity

The traditional method of making cellulose acetate has been to acetylate one form or other of cellulose, either cotton or wood pulp, with a mixture of acetic acid, acetic anhydride and a catalyst such as sulphuric or perchloric acid. In this acetylation process the cellulose dissolves in the reaction mixture; indeed, it is one of the criteria of completion of reaction that the cellulose should be completely dissolved and it is customary to examine the reaction mixture periodically with a low power microscope to follow the rate of solution of the cellulose. After the acetylation process is complete it is customary to hydrolyse the so-formed cellulose triacetate back to a "secondary" acetate which usually carries 2·3 acetyl groups on each glucose residue; the "secondary" acetate thus formed is isolated and purified and then dissolved in acetone from which it is dry-spun by extrusion through small orifices into a current of warm air.

It is true that the starting material for this process is fibrous but it is not a fibre which can be used for textile purposes; for example, if cotton linters are the raw material (as they invariably were for many years) the staple length

of the cotton is too short for it to be spun into staple; if timber is, as it usually now is, the starting material, then it is similarly impossible to spin wood pulp into staple although it is essentially fibrous in nature. Although it is true that in the classical methods of preparing cellulose acetate, fibrous material has been used to begin with, and that this has been dissolved and then reprecipitated in fibrous form, there has been no real loss because the initial fibrous form was incapable of textile use. Although at first sight it seems wasteful to start with a fibrous material, to dissolve it and to reprecipitate it in fibrous form, it is only when we remember that the initial fibrosity was not useful in a textile sense whereas the final fibrosity is useful, that we see a vindication for the old process.

### Avoidance of Solvents: Acetylation of Viscose Rayon

At one time the dry-spinning of cellulose acetate was considered an advantageous feature; the process was clean and it avoided the lengthy wet operations of the viscose process; for many years cellulose acetate and viscose rayon were the only man-made fibres, save for a little cuprammonium. As time has gone on, the viscose process has been enormously improved, the wet operations have been reduced in number and have been unified into one continuous spinning process so that the old advantage of dry-spinning over the wet-spinning of viscose rayon (that it saved labour) has, virtually, disappeared. Furthermore, dry-spinning involves the use of acetone or some such solvent which has to be recovered; recovery plants are expensive to install and always a little solvent is lost when they are operated; in this respect the dry-spinning of acetate is at a disadvantage compared with the wet-spinning of viscose which only requires the use of water, not of any other solvent. Although 20 or 30 years ago dry-spinning was considered advantageous, today wet-spinning is much more attractive.

It is considerations such as these which have pointed the way to those fibrous acetylation processes which are now being used or introduced. In this country Cotopa is made by the partial acetylation of cotton fibre and is advantageous in respect of heat stability and microbiological resistance; but cotton as a starting material is dear and a fibre that is made from it can never be cheap.

In Japan, viscose rayon is used as the starting material for Alon and is acetylated to a cellulose acetate which contains about 2·2 acetyl groups per glucose residue. The fibre so made is on sale and its use is growing. Its method of manufacture represents a complete departure from anything else that has been used for acetate; it uses as raw material viscose rayon which is the cheapest of all apparel fibres and the Alon production process consists essentially of the continuous acetylation of viscose rayon. Economically it has the big advantage that the spinning process is effected from an aqueous solution and not from an organic solvent. There are no solvent recovery losses—in the spinning operation at least. Probably it is in the economy of its manufacturing process that the main advantage of Alon is to be found; the use of viscose rayon, cheapest of all apparel fibres, as the starting material is one great advantage; the retention of fibrosity is another great advantage. Staple viscose, made from timber, is far cheaper than any cotton, and its use eliminates the need for any further spinning process.

### Properties of Alon Fibre

In the main the properties of Alon fibre are similar to those of ordinary cellulose acetate, rather more similar in many respects to those of cellulose triacetate than to those of secondary acetate. There are, however, some quite significant differences and these require a little consideration.

*Basic Fibre Construction.*—Because Alon is made from viscose staple fibre and because the acetylation process has consisted only of the establishment of a multitude of side-chains on the fibrous molecule and has not interfered with the fibrous molecular backbone, the fibrous structure of Alon resembles more closely that of viscose rayon than that of ordinary cellulose acetate rayon that has been dry-spun. If we consider the architecture of the fibre rather than the type of "bricks" of which it is built then Alon resembles most closely viscose rayon; on the other hand, if we consider the chemical nature of the fibre, i.e. the "bricks" of which it is made, then Alon of course is cellulose acetate. But the fibrous structure is on the lines of viscose rayon and carries with it some of the valuable properties of viscose, attributes that are not ordinarily found in cellulose acetate fibres.

*Mechanical Properties.*—The mechanical properties of the fibre derive directly from the structural arrangement of the molecules. The tenacity of Alon is 2·8 grams/denier and this is as high as that of a good viscose rayon and twice as high as that of an ordinary cellulose acetate rayon. Even when wet Alon has a tenacity of 2·2 grams/denier, again more than twice that of ordinary cellulose acetate rayon. Even when knotted (single half-hitch) Alon has a strength of 1·8 grams/denier whereas under similar conditions cellulose acetate has a tenacity of only 1·1 grams/denier. The high tenacity of Alon is a consequence of the use of *high-tenacity* viscose staple as the raw material for its manufacture. True elasticity, that is recovery from stretch on release of tension, is not very much different from that of ordinary cellulose acetate; recovery is good from stretches of not more than 5% but gets progressively poorer with higher stretches. The elongation at break of Alon is 23% and this is more than adequate for all normal requirements; it is a shade lower than that of normal cellulose acetate (27 - 28%) but the difference has no practical significance.

*Moisture Regain.*—Ordinary secondary cellulose acetate is made by complete acetylation to the triacetate followed by partial hydrolysis to a state in which each glucose residue carries on average 2·3 acetyl groups instead of the 3 which saturate it. During the partial hydrolysis some acetyl groups are removed from the fibrous molecule and are replaced by hydroxyl groups. It seems likely that in this partial hydrolysis it will be those acetyl groups which are most accessible from the surface that will be replaced by hydroxyl groups so that the hydroxyl groups which are present in secondary cellulose acetate will be situated in the most accessible positions on the fibre molecule. Consequently the hydroxyl groups in secondary cellulose acetate should be extremely active; in particular their affinity for water molecules will be able to be exercised to the full. If now we consider Alon we know that this fibre is made by direct acetylation of viscose rayon to the stage at which each glucose residue carries 2·2 acetyl groups on average. Not all of the hydroxyl groups on the viscose rayon have been acetylated but only some 73% of them (2·2 is 73% of 3·0) and those hydroxyl groups that have been replaced by acetyl groups will be those that were on the surface and that were most accessible to the acetylating agents operating from the surface. Consequently, those hydroxyl groups

that remain as hydroxyl groups in the Alon fibre will be those that were least accessible from the surface; they can be expected to be less active and probably only able to demonstrate in part their affinity for water molecules. With these considerations in mind it might be expected that the affinity for moisture of secondary cellulose acetate would be greater than that of Alon despite the fact that Alon carries a slightly higher percentage of hydroxyl groups than does secondary acetate. This expectation is borne out in practice and under standard conditions (65% R.H. and 70°F.) Alon has a moisture regain of only 5% compared with a value of about 6·5% for secondary cellulose acetate. It seems fair to attribute this difference to the lower degree of accessibility of the hydroxyl groups in the Alon molecule. Correspondingly, in very high humid conditions, e.g. 95% R.H., Alon has a moisture regain of 9·5% compared with 14% for secondary cellulose acetate. For comparison it should be remembered that under standard conditions where Alon has a regain of 5%, cellulose triacetate has a regain of 4·5% and nylon a value of 4%. From the point of view of its use for apparel a low moisture regain in a fibre is disadvantageous. The high moisture regains of wool and allied hair fibres and the fairly high regain of cotton and similar cellulosic fibres render them particularly suitable for apparel. All living organisms contain a large amount of water and the quantity of water in our bodies or in a leaf is always changing; in order to be compatible with living organisms a fibre should have a high moisture regain so that it can act as a moisture reservoir between the body and the atmosphere. Wool and cotton are ideal; the synthetic fibres (with nylon a partial exception) are poor; viscose rayon is good, cellulose acetate rayon not quite so good and Alon again less good than secondary cellulose acetate.

*Heat Resistance.*—Probably because it has the tough molecular backbone of viscose rayon Alon shows good resistance to heat; it is more resistant to a hot iron than is secondary acetate and in this respect it behaves like triacetate. The better heat resistance of Alon enables it to be dyed satisfactorily in blends with "Terylene" and other fibres which require high temperature dyeing.

*Freedom from Pilling.*—The makers of Alon (Toho Rayon Co. Ltd.) claim that Alon is less likely to pill than most synthetic fibres. If this claim is eventually borne out and there seems to be some justification for it, then that will be a fibre feature of some importance because pilling is a very great nuisance to the consumer. It seems wiser to say no more about this until more extensive experience has been gained with Alon in this country.

*Handle.*—Handle is a complex property; it is not yet possible to measure it objectively and it can only be assessed on the basis of comparison with other fibres in the hands of people practised in assessing this quality. There is no doubt at all that the one property which had more influence than any other 30 years ago in popularising secondary cellulose acetate was its pleasant and soft handle. It is the writer's personal opinion that the handle of cellulose triacetate is not nearly so soft as that of secondary acetate, and that the handle of Alon is closer to that of triacetate than to that of secondary acetate. This is a disadvantageous feature and may possibly be associated with some incipient fusion on the surface of the fibre which may take place during acetylation. This again is only an expression of personal opinion.

### Manufacturing Process

Complete details are not available but such information as there is suggests that the manufacturing process for Alon runs somewhat as follows:—

*Pre-treatment.*—Viscose tow staple or yarn is dipped in a catalyst solution, possibly sodium acetate, to make it reactive. The fibre is removed and dried.

*Acetylation.*—The fibre with the catalyst dried in is put into a tubular continuous acetylation equipment and through it there is passed air carrying the vapours of acetic anhydride and acetic acid. Fibre is continuously fed into the tube and continuously taken from it; the process takes several hours. The cellulose actate which comes continuously from the reaction tube is washed with water and dried.

### Dyeing

Alon can be suitably and most easily dyed with disperse dyes. As already indicated its better heat-resistance enables it to be dyed at temperatures higher than those that are safe with ordinary cellulose acetate. A resin finish can be applied if desired.

### Assessment

The use of viscose staple, the world's cheapest apparel fibre, as raw material, together with the avoidance of any solvent spinning, should make Alon a very cheap fibre and should make it capable of entry into lower price markets than cellulose acetate has hitherto entered. The present cost of Alon in Japan is 67 cents/lb., equivalent to about 4s. 8d. per lb., but it is intended to reduce its price to 55 cents/lb. very shortly. In the U.K., secondary acetate staple costs only 3s. lb. and triacetate staple about 4s. 6d. lb. It seems that the low cost potential of the Alon processes have not been fully utilised but the chances are that the fibre should eventually sell at a price significantly lower than that of secondary acetate. Production is still low, only about 3 to 4 million lbs. per annum.

The second important point is the high tenacity and good mechanical properties that result from the use of high-tenacity viscose staple as a raw material. These properties would be extremely difficult to match by any orthodox preparation of cellulose acetate and this high strength may be the making of Alon commercially.

To offset the big advantage of high tenacity and the big potential advantage of low production costs there are two disadvantageous features which must not be forgotten. The first is the relatively low moisture regain and there is probably nothing that can be done about this; it is low but it is not extremely low; it is higher than that of nylon for example. The second is lack of softness of handle; this feature is of cardinal importance.

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## *Modern Lace Nets*

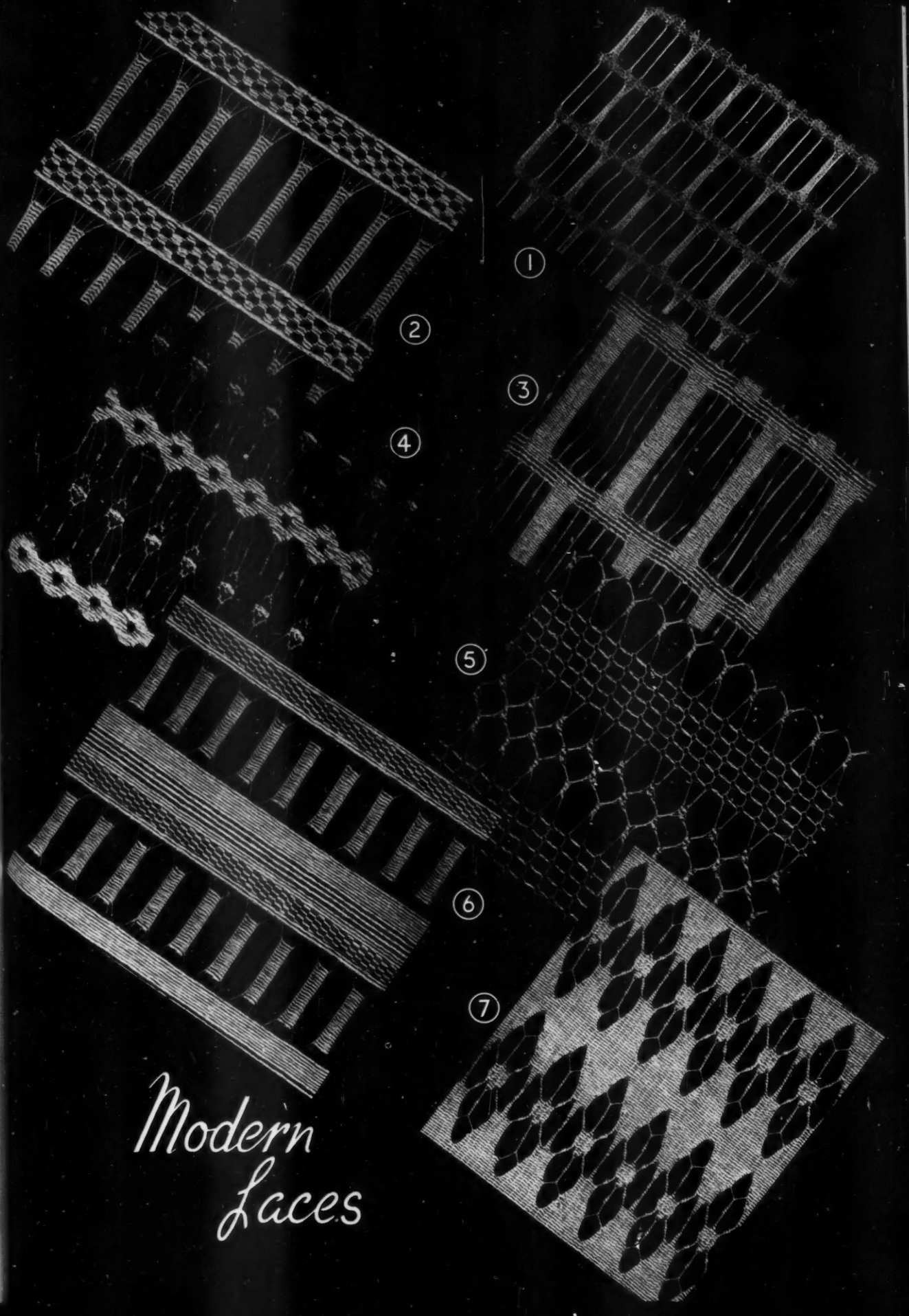
**The small patterns reproduced on the facing page are a representative selection of the beautiful specialities in "Vision Nets" made by Clyde Manufacturing Co., Clyde Works, Radford, Nottingham. Brief details are as follows:—**

**(1) T.6832; (3) T.6836; (7) T.6834. These three are made in 36 ins. and 48 ins., but can, if required be made 60 ins. wide.**

**(2) T.6740; (4) T.6920; (5) T.6919; (6) T.6878. These four are made in 40 ins. and 60 ins.**

**Manufactured from cotton reinforced with "Terylene" (92½% cotton - 7½% "Terylene"), all these nets are finished in white and vat dyed biscuit. They are "Denicised" drip-dry finish and need no ironing. This is an important feature as the large mesh of the fabric would be impracticable if it required to be ironed.**

**Incidentally (7) T.6740 was selected as one of the twenty "Designs of the Year 1958" by the Council of Industrial Design. It is also done in colours—red, yellow, nasturtium, grey, black, green, blue, and is used with contemporary furnishings as a "divider" curtain in the open room type of house, as well as for windows in the usual white or biscuit.**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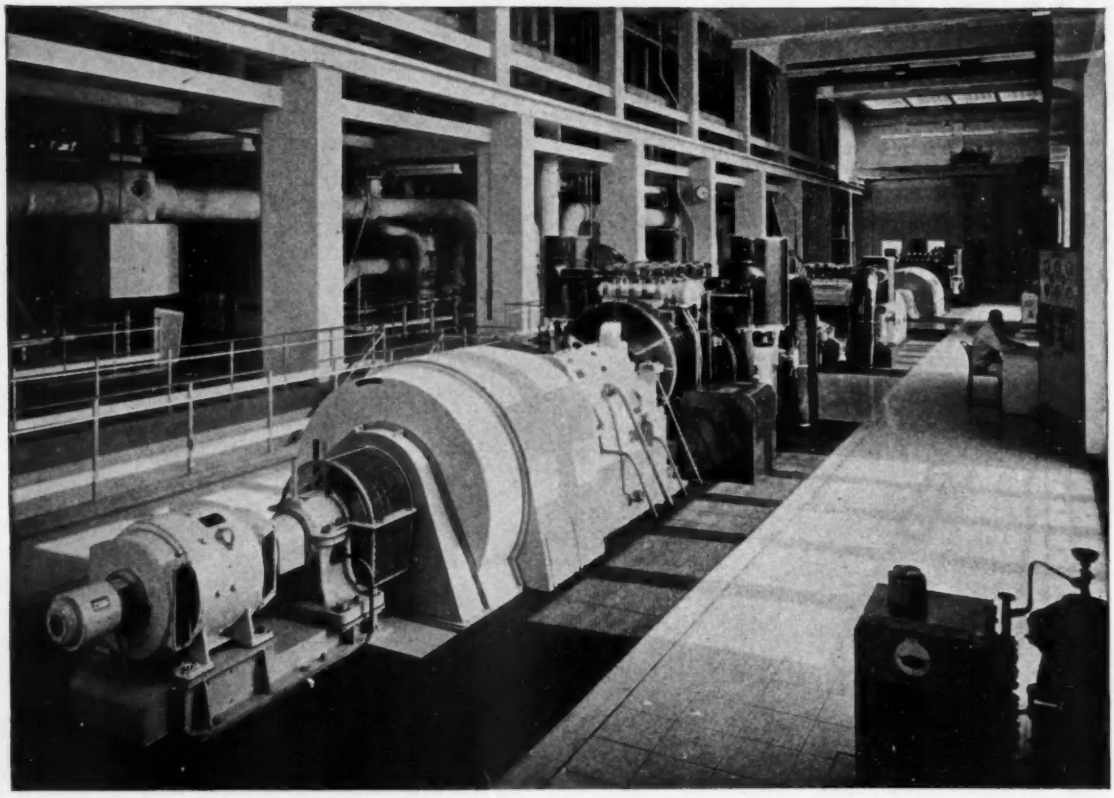
Modern Laces

# Power from Process Steam



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# Clothing China's Enormous Population*

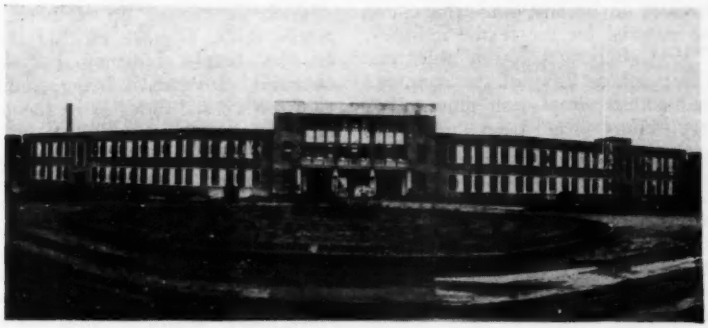
*In getting to grips with the problems of satisfying the increasing textile demands of her huge population China is now said to have 70% more cotton spindles, 36% more woollen spindles and double the number of jute looms than in 1949*

By YEN FANG

THE total output of cotton cloth in China in 1949 was 1,890 million metres and the national wardrobe averaged only 2·55 metres per person; in the rural areas it was even less, under 2 metres. That was the starting point when the country set out to solve the problem of clothing something like a quarter of the world's population. To add to the difficulties, most machinery was worn out and China had no machine-building industry to replenish it. About 87% of the existing 5 million cotton spindles—the total built and in use in the 60 years prior to 1949—were concentrated in a few coastal cities away from the cotton growing areas and consumers. Shanghai, possessing half the country's spindles in 1949, had to import not only its entire machinery but 80% of its cotton; half the cotton used in the entire textile industry was imported.

China's policy since then has enabled her textile industry to free itself of its former dependence on imports for equipment and raw material and development has been rapid. Compared with 1949, the 1958 output of cotton yarn has increased 3·4 times, cotton cloth 3 times, woollen fabrics 4·8 times and silk fabrics 3·9 times. Further increases are being registered this year. In the first six months cotton yarn output showed a 46% increase. An estimated 8·2 million bales will be produced by the end of this year. In other words, China will have achieved her 1962 cotton yarn target of the second five-year plan three years ahead of time. Similarly, cotton cloth showed a 31% increase in the first six months, and woollen and silk textiles 40%.

As more cloth is produced in China, the standard of the nation's wardrobe increases. This year the *per capita* consumption of cotton cloth will reach over 8 metres, more than doubled that of 1949. In the rural areas it will be more than 3 times. The *per capita* consumption of knitwear, woollen yarn, woollen textiles, silk, etc., has also increased. Compared with 1952, the figures for 1958 were 3 times higher, knitwear 2·5 times, woollen textiles and silk 2 times.

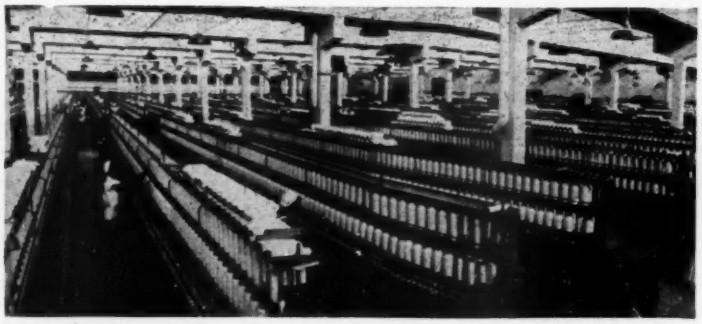


China's largest spinning, manufacturing, etc., hemp factory in Canton began production in 1958

One reason given for the rapid expansion of China's textile industry is her policy of simultaneous development of light industry and agriculture on the basis of giving priority to heavy industry. China now relies on herself for equipment and raw material and these factors together with a domestic market of 650 million people ensure the steady development so markedly

An experienced cardroom operative demonstrating the best way of piecing-up on flyframes to other girls in a mill in Sinkiang

*An exclusive contribution from "China Features"



An installation of modern ringframes in the Peking No. 1 mill

apparent in the textile and other branches of light industry.

China has all the conditions necessary to become self-sufficient in raw material for the textile industry. In 1948, imported cotton amounted to as much as 78% of the country's total cotton crop but since 1949 every effort has been made to encourage the peasants to extend the area under cotton and other industrial crops. The state has helped them build irrigation facilities, improve seed strains, combat plant diseases and insect pests and has supplied fertiliser. These measures have led to a big increase in output. Compared with 1949, the total cotton output by 1957 has risen 3·7 times, jute 9·5 times and wool and natural silk 2 times, and in 1958 further substantial increases were recorded.

### Machinery Manufacturer

The setting up of an independent textile machinery industry has also been another important factor in the development programme. The few repair plants previously in place were rapidly rebuilt and expanded into textile machinery making plants. In the meantime, new large machinery plants were built and China has thus been able to produce whole sets of textile machinery and plant installations since 1951. Up to 1958, modern textile equipment totalling more than 3·8 million cotton spindles and 90,000 looms were manufactured. Production has also commenced of dyeing, printing and other machines for woollen, silk and linen mills.

To keep pace with the progress in raw materials and equipment, China has also got to grips with the problems of satisfying the increasing demand of her huge population. Over 70 mills were built in the first five-year plan period and since the "big leap" last year another 118 mills have gone into construction, financed by the state. As a result, 70% more cotton spindles and 36% more woollen spindles are in operation than in 1949. The number of jute looms has doubled.

With the setting up of these new textile mills, a more rational layout of the textile industry has been obtained. Instead of being confined to a few coastal cities as in the past, mills equipped with the up-to-date machinery and facilities are now found in every part of the country. Many cities including Chengchow, Shihchiachuang and Sian have become important centres, particularly those in the cotton producing areas in the Yellow and Yangtze river valleys and other inland places. Peking has also built new mills. Each centre has a considerable proportion of spinning, weaving, and finishing machinery. Together with the new workers' housing estates, complete with department stores, theatre, nurseries, schools and post office, each new centre is virtually a city in itself.

### Modernisation and Re-equipment

Existing old mills have been remodelled and continue to play their part in the industry. Working in these mills are thousands of highly skilled veteran workers who are regarded as an extremely valuable asset and form the backbone of the textile labour force. The government has transformed the system of management, improved working conditions and stepped-up the modernisation of existing equipment in the old mills. Fuller utilisation of old equipment and higher efficiencies have enabled the mills to produce more cloth which, in turn, has brought more and more benefits for the workers. Shanghai, for example, is now turning out 3 times the quantity of textiles as formerly. It has also sent 2,500 office personnel and 3,500 skilled workers to other parts of the country to help build the new textile centres.

To keep pace with the demand for variety and better quality products,

Modern automatic screen printing equipment in Shanghai's re-modelled No. 2 mill which also spins and weaves fine cloths

a nationwide campaign was launched in connection with better designs. This brought in numerous suggestions from all sections of the people, ranging from professional artists to ordinary consumers including peasant women. In conjunction with advanced technical measures the response enabled the industry to turn out better quality products. Similarly, the same home-grown cotton used formerly for 20 - 30 counts can now be spun into 150 counts. Raw silk made into CD grade fabrics before 1949, is now easily turned into 2A grade products, the highest being 6A grade. Woollen textiles, poor in quality and small in output before 1949, are now excellent and include overcoatings, gaberdines and suitings. More and more new varieties are being manufactured to meet consumer demand. Instead of the drab homespun black and indigo, the predominant fashion in rural China today is bright colours and better machine-made fabrics.

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### Polyolefin Yarn Expansion

British Celanese Ltd. intend to double the production capacity at Coventry for polythene and other polyolefin monofilament and multifilament yarns. The first stage of the expansion is due for completion before the end of this year and it is planned to have the new plant in full production by the middle of 1960. In established fields such as fishing nets, twines and ropes, fusible interlinings, industrial filters and protective clothing, etc., consumption increases and new types of yarn and the extension of the range of spun-dyed colours accelerate demand in a rapidly growing field of end-uses.

# Roller Slippage Causes Variation in Yarn

*The efficiency of the drafting system, maintenance and roller settings can be checked by comparing the co-efficient of variation of the stock before and after drafting*

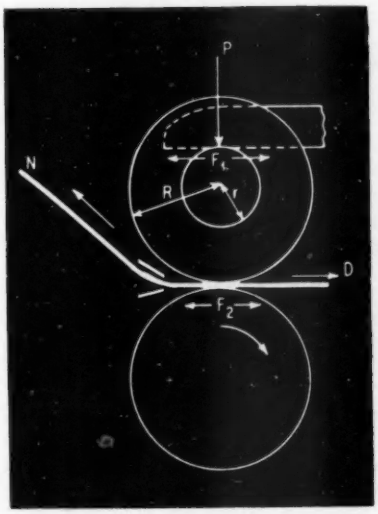
By N. H. POMFRET

SPINNERS generally are well aware of the fact that there is no perfect drafting system and that each machine changes the pattern of variation. The introduction of electronic evenness testers focused attention upon short-term variation, with the result that long-term irregularity is often neglected. It is a common fallacy to assume that machines or processes introduce short-term variation only and that long-term variation is caused by earlier processes or the number of doublings.

Poorly lubricated or choked top front rollers slip and revolve slower than the intended speed, and the yarn produced by such is coarser than that made on the rest of the frame. The obvious coarseness of such yarn is normally detected by the frame operator who makes the necessary corrections. Slippage of the back top roller is, however, much more difficult to detect. This probably slips forward rather than backward. Cleaning and lubricating it will not correct the fault as easily as for the front roller.

A visual picture of the principal forces at work on the back top roller can be obtained by glancing at Fig. 1. If —

$F_1$ = friction between the saddle and the top-roll boss




FORCES that affect roll slippage include friction, drafting pull, bobbin-holder drag, and saddle pressure.

$F_2$ = friction between the top and bottom rolls
$rT$ = radius of the top-roll boss
$R$ = radius of the top roll
$D$ = drafting force
$N$ = resistance caused by friction of the bobbin holder, creel guides, and traverse-motion eyelet.
$P$ = pressure applied by the saddle

Then the surface speed of the top roller should not be less than the surface speed of the bottom roller, or

$$R(F_2 + D - N) > F_1 r$$

In other words, the grip of the fibres by the rollers and the drafting force added together must be sufficient to pull the roving bobbin around and overcome the friction created by the pressure of the saddle on the top-roller boss. If these forces are not strong enough, the top roller will revolve slower than the bottom, the roving will not be fed fast enough, the draft at that particular roller will be too high, and the counts will be too fine.

The surface speed of the top roller should not be greater than the surface speed of the bottom, or

$$R(F_2 + N) - F_1 r > RD$$

Here the grip of the fibres by the rollers and the friction at the roller boss, depending upon the magnitude of the drafting force D, may act in either direction. When D is large enough to overcome the opposite forces, the top roller will slip forward, the roving will be fed too quickly, the draft will not be high enough, and the counts will be coarse.

### Speeds and Drafts

On spinning frames, there may be 100 to 200 front and back top rollers, and it is possible that no two rollers have exactly the same surface speed and draft. In many instances, the differences in surface speeds of the top rolls are so slight that they are of no importance. In other instances the differences may be large enough to cause trouble with count variation.

To check the efficiency of the drafting system, maintenance, and roller settings, compare the co-efficient of variation of the stock before and after drafting. Ensure the same type of variation is being compared, e.g., compare the CV% between the weights of 120-yd. lengths of yarn with the CV% between the weights of 120-yd. lengths of roving divided by the calculated draft.

For example, if 32s yarn is being spun from 2-hk. roving, it is necessary to compare the CV% between 120-yd. lengths of yarn with the CV% between 7½-yd. lengths of roving. If no appreciable slip is taking place, then the two CVs will be approximately the same.

When the front roller slips, it is almost invariably a backward slip because the tension of the yarn (the only force tending to make the yarn slip forward) will cause excessive end breakage before the force is large enough to make the roller slip forward. Evidence of backward front-roller slip is found in long lengths of coarse yarn with excessive twist.

### Roller can Slip Either Way

The back top roller may slip either way, i.e., backward when the tension of the roving is excessive or the aperture of the traverse eyelet is too small for the diameter of the roving, or forward when the drafting force is excessively high. The most common direction of slippage for this roller is forward. Several factors contribute to the forward slippage.

(1) Spinning man-made fibres on frames designed for cotton and with no facilities for adjusting the distance between the back rollers and the next pair.
(2) Staple too long for the drafting system.
(3) Reduction of pressure on the back roller when the rollers are spread.
(4) Break draft too low.
(5) Spinning yarn from hank roving that is too coarse.

Forward slip of the back roller is more prevalent than is commonly suspected. This occurs when the drafting force increases as the staple length approaches the fixed distances between the back two lines of rollers. The increase in force is particularly large when the distance between the roller nips is near the staple length of the stock.

Another cause is the increased mean fibre length of man-made fibres compared to the mean fibre length of cotton of equivalent staple. The drafting force also is high when the draft is low, which is usually the case between the back and succeeding roller on cotton-system frames.

With a staple length almost equal to the distance between the roller nips, coarse roving, light pressure on the back roller, and a low draft, the drafting force may become so great that it causes the back top roller to revolve at the same surface speed as the succeeding roller. When this occurs, the total draft of that particular set of rollers is reduced in proportion to the amount of break draft.

## Yarn Quality

(*Continued from page* 540)

From _____ Serial No. _____

To _____ Date. _____

| Complaint | Mule Ring No. | Date Spun | Overlookers Remarks |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

B.S.51 Note: Use other side of paper if necessary. Signature _____

**Fig. 14. Another form of card for recording complaints**

roving are tabulated and running graphs are kept of these wrappings with tolerances clearly marked. Efficiency tests are carried out on the cleaning machinery and many tests and check tests are carried out on the waste extraction in the mills.

In the spinning rooms, routine end break tests are carried out as well as routine wrappings to keep the count correct, and weekly records and graphs kept of the yarn strengths (Figs. 12, 13 and 14). In addition, some standard quality yarns are checked visually by the technical management every week and running graphs kept of the gradings. Various controls are in operation to keep the machinery in first-class condition and inspection is carried out through the mills every week. All this enables us to keep a fairly good control over yarn quality and to assess yarn quality on broad lines. It is far from perfect but it is a feature of our organisation which we hope helps the weaver.

**Acknowledgments**

**Thanks are due to the directors of Knowles Ltd., Bolton, for permission to give this talk and I would also like to acknowledge the assistance of a colleague, Mr. John Dawber, A.T.I., of the company's Research Department, in the preparation of the subject matter.**

# Dyeing and Printing Polyester with Polyestren Dyestuffs

EXPERIMENTS had shownth at the valuable properties of polyester fibre, for instant crease recovery, were markedly noticeable in mixtures of 2/3 polyester and 1/3 cotton. At present polyester/cotton, 67/33 mixed fabrics, were being used on the Continent and abroad to quite an extent for shirts, blouses, dress goods, raincoats, tropical wear and even military uniforms, said, Mr. H. Musshoff (Cadella Farbwerke) in a recent address to the Manchester Section of the Society of Dyers and Colourists. He was speaking on the subject of dyeing and printing polyester and polyester/cellulose mixtures with Polyestren dyes.

Polyester and linen were mixed 50/50. Both types of fabrics contained the fibre mixtures in warp and weft. Fabrics with polyester warp and cotton weft had been manufactured but did not show the good properties as fabrics of spun fibre mixtures did. In an investigation as to whether vat dyes were suitable for the dyeing of polyester, the following points should not be overlooked:—

(1) The method of application should be as simple as possible and should include the possibility of dyeing continuously.
(2) The use of carriers should be eliminated.
(3) The fastness properties on polyester and on cellulose should be the same.

The first trials were carried out on the jig using leuco-acid (triethanolamin plus hydrosulphite) like dispersed dyes. On account of their poor affinity only pale shades were obtained, but it was found that the depth of shade could be increased by heat setting. The experiments led to the investigation of the behaviour of highly dispersed vat dyes when padded on the fabrics as pigments, followed by heat setting. The results were very promising, therefore the range of Indanthrens was tested and the most suitable dyes were selected and were now available as Polyestren dyes.

The range of Polyestren dyes consisted for the time being of nine different colours. Compared with the 160 Indanthrens available at present, nine appeared small but in spite of that they anticipated to have a few more dyes at hand in the future, especially synthesised for dyeing polyester.

The following operations were necessary to apply the Polyestren dyes: padding - drying - heat setting - reduction bath-finishing.

Fabrics were padded cold on a conventional two-bowl padding machine with the dispersion of Polyestren dyes. Padding was more difficult on polyester than on cellulose as the former took up less padding liquor. Filament behaved worse than spun staple. To overcome the difficulties a thickening agent was added to the padding liquor but the colour yield depended upon the type and the quantity of the thickening agent.

A hot flue or a pin stenter could be used for drying the padded goods. The theory of the heat-setting process that the dye did not only migrate into the fibre but was dissolved within the fibre was encouraged by the fact that the hue of a vat dye on polyester was the same as its tint in organic solvents.

Temperature played an important role but the optimum was 210 - 215°C. as read off the thermometer, roughly 205°C. on the surface of the cloth. Lower temperature gave a poorer colour yield, higher temperature might impair the quality of the fibre. Heat setting took 40 - 50 secs. It was possible to improve the colour yield by heat setting at 180 - 190°C. by adding urea or Glycin A to the padding solution but this would increase dyeing costs enormously.

Drying and heat setting could be carried out on one and the same machine, for instance on a pin stenter, the first part of which was operated at the low drying temperature whilst the last two field or compartments were operated at the higher curing temperatures.

When dyeing pale shades on pure polyester a reduction bath was not necessary unless a very bright shade was required. For medium and heavy shades, however, a reduction bath had to be used to clean the fabric by washing off the surplus dye which was not properly fixed.

The dyeing procedure for polyester/cellulose mixed fabrics was generally the same as for pure polyester with the exception that the dye taken up by the cellulose during padding was not fixed on that fibre during thermo-setting but in the reduction bath.

Regarding continuous dyeing with Polyestren dyestuffs the method of application was nearly the same as that of dyeing pure cotton piecegoods with the only difference that of an additional heat-setting process which could be considered as a prolonged dyeing. Since Polyestren dyes were fixed on polyester during heat setting, the printing with this group of dyes was amazingly easy. The Polyestren printing brands were ideal products for direct printing of polyester/cotton mixed fabrics.

### New Synthetic Fibre

Cyanamid International announce that their new acrylic fibre Creslan is to be made available in Europe. Creslan combines the desirable feature in both natural and synthetic fibres. Although quick drying it is said to absorb dyes easily. The new fibre is being used in the U.S.A. in women's and men's suitings, dresses, sweaters and fur-resembling pile coats; in children's clothing; in inner clothing; and in home furnishing including upholstery, carpets, blankets and curtains. Cyanamid of Great Britain Ltd. (the British member of Cyanamid International) says that small quantities of Creslan have already been imported from the U.S.A. for experimental purposes.

# Locating Faults in A.C. Motor Starters

*A discussion of the possible faults on main circuits, checking main circuits, testing for interruption of main circuits, also explanations of control circuit faults which might prevent starting*

By "ENGINEER-IN-CHARGE"

WHEN an a.c. motor fails to start on pressing the "Start" push button, or on operating the control switch, delay in restoring the machine to service can be minimised by systematic fault location. The first step is usually to check whether any of the fuses controlling the motor circuit have melted, or whether a circuit-breaker in the motor circuit has tripped. If one or more fuses has melted they should be replaced, making sure that the size is correct. Table 1 gives suggested sizes of cartridge or re-wirable fuses for 415-volt 3-phase motor circuits. Where re-wirable fuses are used the complete set of fuse wires should be replaced if one fuse melts. This ensures that the same sizes of fuses are used in each phase, thus avoiding risk of damage to a motor by "single-phasing" as might occur due to one fuse only melting due to the size being too small or the wire having been burnt.

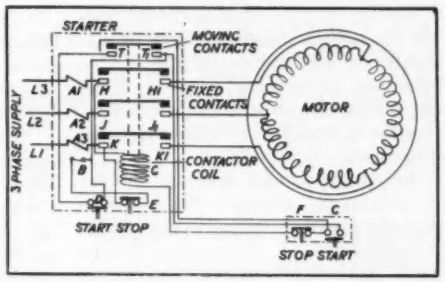



**Fig. 2. Connections of a three-phase motor having a direct-on-line starter**

Where more than one motor is fitted on a machine tool the current rating of the fuses or overload circuit-breaker controlling the machine tool should not be greater than four times the current rating of the largest motor, plus the sum of the current ratings of the other motors on the machine tool.

**Table 1. Suggested Sizes of Fuses for 415 Volt, 3-Phase Motors**

| 1. | 2. | Direct-on-line starter | | Star-delta, auto-transformer or resistance starting | |
|---|---|---|---|---|---|
| Rated horse power of motor | Approx. full-load current in amps. | 3. Current rating of cartridge fuses amps. | 4. Number and size (s.w.g.) of fuse wires | 5. Current rating of cartridge fuses | 6. Number and size (s.w.g.) of fuse wires |
| 1 | 1·7 | 6 | 1/22 Tin | 6 | 1/24 Tin |
| 2 | 3·4 | 10 | 1/30 Tinned-copper | 6 | 1/22 „ |
| 3 | 4·8 | 15 | 1/25 „ | 10 | 1/32 Tinned-copper |
| 4 | 6 | 15 | 1/24 „ | 10 | 1/30 „ |
| 5 | 7 | 20 | 1/24 „ | 15 | 1/28 „ |
| 7½ | 10·5 | 30 | 1/21 „ | 20 | 1/25 „ |
| 10 | 13·5 | 35 | 1/19 „ | 25 | 1/23 „ |
| 20 | 26 | 80 | 1/17 „ | 50 | 1/19 „ |
| 30 | 39 | 100 | 1/15 „ | 60 | 1/17 „ |
| 40 | 52 | 160 | 1/14 „ | 80 | 1/15 „ |
| 50 | 64 | 160 | 2/17 „ | 100 | 1/14 „ |

## Possible Faults on the Main Circuit

Assuming the size of fuse, or the setting of the overload circuit-breaker, controlling the motor circuit is correct; the melting of the fuse, or tripping of the breaker, is likely to be caused by stalling or overload of the motor, a short circuit or an earth fault on the motor circuit. However it might result from single-phasing of a three-phase motor, or due to an accelerating contactor sticking in the closed position. The motor should be checked to ensure that it is free, if possible.

If the fuse melts, or the breaker trips, a second time it is advisable to check the insulation resistance to earth of the motor circuit, and preferably the insulation resistance between poles, by means of a test set such as a "megger."

If the fuses have not melted, nor the breaker tripped, it is quite likely that the fault lies in the control circuit. If the starter is arranged for either automatic or hand control an attempt should be made to start the motor by the hand control. If this is successful this indicates that there is a burnt contact, sticking switch or a loose connection in the automatic control circuit.

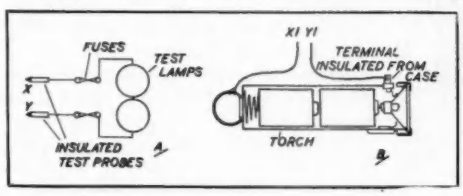



**Fig. 1. Two simple circuit testing devices**

## Checking the Main Circuit

Otherwise the control circuit can be checked by closing the first (starting) set of main contacts in the starter by hand through the medium of a substantial piece of insulating material, taking care not to touch any contacts. Many types of control gear are fitted with a mechanical interlock to prevent access to the interior of the control gear except when the isolator is off;

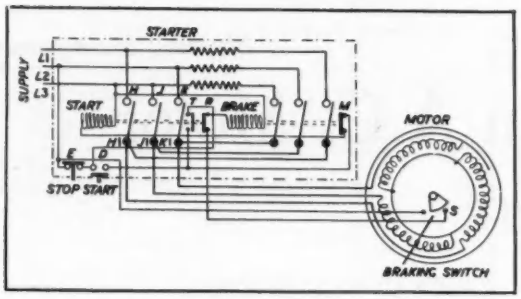



Fig. 3. Connections of a direct-on-line starter arranged for braking by plugging

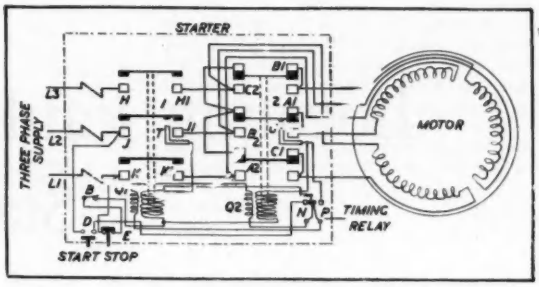



Fig. 4. Connections of one type of push-button controlled star-delta starter for a three-phase motor

such an interlock must be rendered inoperative to check the operation of the gear. It may be necessary to press a screwdriver, or similar device, into the mechanical interlock in place of the projection which normally operates the interlock, or to adopt other methods depending on the type of interlock, so that the isolator can be closed with the door open.

An automatic star-delta starter may have a main contactor No. 1 as in Fig. 4, together with a changeover contactor No. 2. This should start when the contacts of No. 1 contactor are closed by hand if the changeover contactor is making proper contact in the "star" position. Other types of automatic star-delta starters may have a main contactor together with separate star and delta contactors. To start such a starter by hand the main and star contactors must both be pushed into the closed position. A slip-ring motor may fail to start when the main (stator) contacts are closed if there is an open circuit in the rotor circuit, as might occur due to a loose connection or to the brushes not making proper contact with the slip rings.

### Testing for Interruption of Main Circuit

If the motor fails to start when the main starting contactor (or contactors) are closed by hand a fault in the main circuit should be looked for. The first step is to find whether all the phases of the supply are available at the starting contacts. Fig. 1a shows a simple testing device for this purpose, consisting of two series-connected lamps of equal wattage and phase-to-neutral voltage. These should be applied between the supply terminals at the main contacts with the isolator on, i.e. between H and J, H and K, and J and K in Figs. 2, 3 or 4. In each case the test lamps should light if the three-phase supply is available. If the lamps do not light the tests may be repeated at the next switch or distribution point to the starter, and so on, until the point of interruption is located. It is not sufficient to use a single test lamp between the case, or neutral, and each phase in turn. This would not reveal a break in a conductor which was short circuited to a conductor on another phase.

If the supply is available at the main starting contacts but the motor, when free, does not start when the starting contacts are closed by hand, trouble on the main circuit should be looked for. A short circuit or earth fault would probably melt a fuse or trip the breaker, but this may not occur in the event of an open circuit. A simple test set for open-circuit testing is indicated in Fig. 1b. It consists of a torch having an insulated terminal which is connected to the reflector. Test leads $X^1$ connected to the case, and $Y^1$ connected to the terminal, are in parallel with the torch switch. The lamp should, therefore, light when the leads are applied to the ends of a complete low-resistance circuit, such as a motor winding.

If there is no open circuit in the motor circuit the lamp should then light with equal brilliance when the leads $X_1$ and $Y_1$ are applied between the outgoing contacts of the starter ($H_1$ to $J_1$, $H_1$ to $K_1$, and $J_1$ to $K_1$ in Figs. 2 or 3). In the case of the star-delta starter indicated in Fig. 4, the test lamp should also light equally when the leads $X_1$ and $Y_1$ are applied between $A_1$ and $A_2$, $B_1$ and $B_2$, $C_1$ and $C_2$, with the contacts of the changeover contactor No. 2 separated by a thin strip of insulation. If these results are not obtained the tests should be repeated at the corresponding terminals on the motor. If the lamp does not light equally at these points an open circuit in the motor winding is indicated. If the lamp lights equally at the starter but not at the motor an open circuit in the cable between the motor and starter is indicated. This could be tested with the lamp leads connected between the ends of each cable in turn, after disconnecting the cable conductors at both ends.

### Control Circuit Faults which may Prevent Starting

If the motor starts when the starting contacts are closed by hand or does not respond to an auxiliary control or starting push button etc., a fault in the control circuit is indicated. This may be due to an open circuit caused by a melted control-circuit fuse, sticking or burnt contact or a connection which has come adrift. Points which then need checking are start push button contacts (D in Figs. 2, 3 and 4), stop button contacts (E in Figs. 2, 3, and 4), remote stop button contacts (F in Fig. 2), overload trip contacts (B in Figs. 2 and 4), electrical interlock contacts (M in Fig. 3), or timing-relay contacts (N in Fig. 4). Limit switches and any external switches should also be checked. If the control circuit is energised between one phase and neutral the motor may start by hand, but not automatically, if there is an open circuit in the neutral. This fault may be checked by means of a mains voltage lamp applied between each phase and neutral at the starter.

The operating coil may be burnt out, in which case the insulation of the coil will usually be discoloured and brittle, or the coil may be open circuited. The latter defect may be suspected if a lamp of coil voltage lights when connected to the coil terminals and the control circuit is operated, whilst the coil makes no attempt to function. An open circuit in the coil may be confirmed if no reading is given on a "Megger" connected to the ends of the coil after disconnecting the coil from the rest of the circuit. In case of difficulty a systematic check may be made by connecting the test lamps shown in Fig. 1a across the connections to each pair of contacts in the

(*continued on page 564*)

# TEXTILE MACHINERY and MILL EQUIPMENT NEWS

# New U.S. Cotton Bale Opener-Cleaner

*Developed by the Southern Utilisation Research and Development Division of the U.S.D.A. Research Service, this new machine is reported to deal with 1,600 lbs. per hour of uncleaned cotton*

By J. GRINDROD

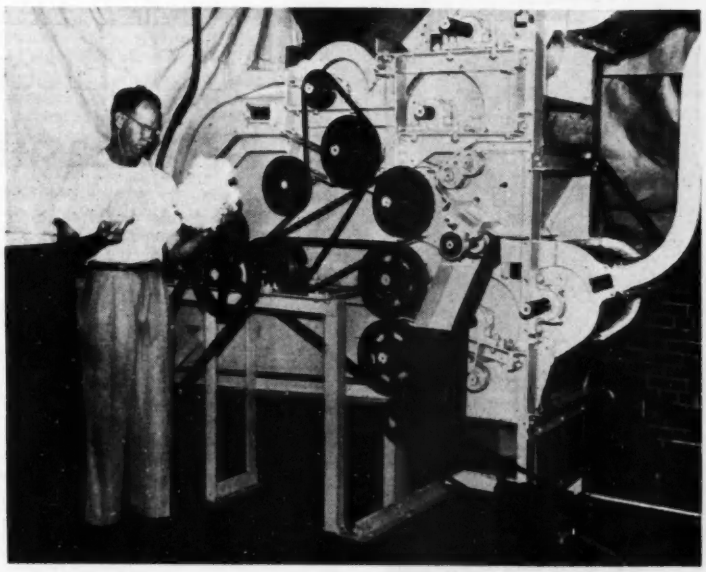
A NEW cotton bale opener-cleaner which is said to have shown savings of up to 100 dollars a day per machine has been developed by the U.S. Department of Agriculture Research Service. It has been designed to combine superior bale opening and blending abilities with outstanding efficiency in cleaning cotton. At least 18 of the opener-cleaner units have been installed in textile mills, and others are on order. One large mill group plans to install 10 of the units this year.

The opener-cleaner is basically the S.R.R.L. cotton opener, an earlier development of U.S.D.A.'s Agricultural Research Service, but with a built-in cleaning device. Designed by Mr. R. A. Rusca and Mr. R. C. Young of the Southern Utilisation Research and Development Division, New Orleans, it has the high production capacity of up to 1,600 lbs. of cotton per hour.

### More Spinnable Fibre

U.S. scientists and cotton industry representatives alike believe that the opener-cleaner may especially prove to be an important factor in the South's transition to mechanised cotton farming. It has proved efficient in removing the trash—the stems and leaves—that are a mark of mechanically or rough hand-harvested cotton, cutting almost in half the loss of spinnable fibre, and is said to represent a major contribution of a broad U.S.D.A. research effort toward developing a complete system for cleaning cotton.

This research involves not only developing more efficient cleaning equipment, such as the opener-cleaner, but integrating that equipment into the total cotton processing operation. Along this line, U.S.D.A. scientists are currently developing a promising carding cleaner that will complement the opener-cleaner and thus represent a still further step toward a complete and superior cleaning system. The principle of the opener-cleaner is covered by U.S. Patent No. 2,780,839, issued in 1957. The opener-cleaner, it is reported, is currently being manufactured by four firms under U.S.D.A. licence.

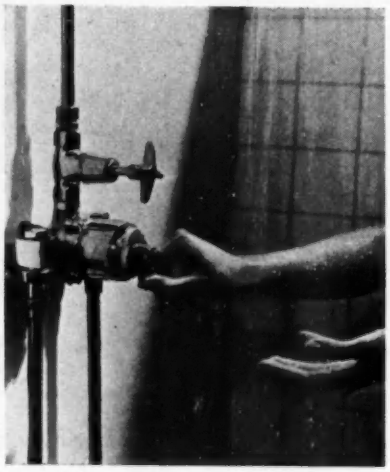


**The opener - cleaner, developed by the U.S. Agricultural Research Service, combines excellent bale opening and blending with high cleaning efficiency and is said to halve waste lint losses**

# New Water Mixing Valve

THE Leonard 21, a new addition to the thermostatic hot and cold water mixing valves, made by Walker, Crosweller and Co. Ltd., Cheltenham, embodies thermostat cartridge construction with elegant design and robust working parts. The powerful double coil bi-metallic thermostat gives effective temperature control. The hot and cold water supplies enter the mixing pillar through ports, the opening of which is controlled by a ported sleeve rotating outside the pillar. The sleeve is connected to a bi-metallic thermostat situated over the outlet of the mixing pillar. This receives and reacts to changes in the mixed water temperature almost instantaneously. Under normal conditions the mixed water temperature is maintained within ± 2°F.

The thermostat assembly is self-contained and fits into the body as a cartridge fits into a gun. After undoing the four cover screws and removing the cover, the thermostat assembly can be pushed out and put back again or replaced without the use of any tool whatsoever. This principle of cartridge construction will be appreciated by hospital and works engineers who have to carry out maintenance work in the shortest possible time. The manufacturers state that this new mixing valve is intended for single showers, single wash basins, etc., and for process work requiring small quantities of warm water controlled at a precise temperature, such as colour film washing.



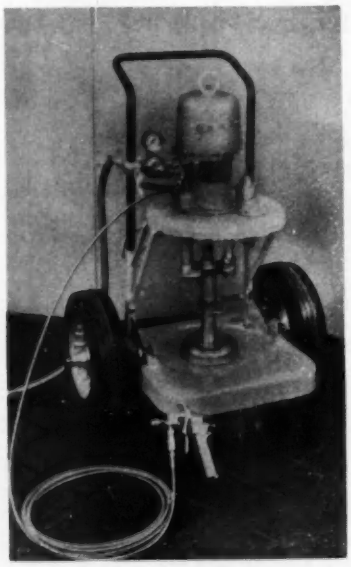
**New Leonard 21 thermostatic mixing valve with top outlet for shower**

# High Pressure Mobile Spray

THE truck-mounted Hydra-Spray, shown in the accompanying photograph, operates by use of high hydrostatic pressures, varying from 1,000 to 3,000 lbs. sq. in. These high pressures are achieved by the use of a reciprocating, double-acting air motor, coupled by a connecting rod to a reciprocating double-acting pump which multiplies the fluid pressure to twenty times the air pressure admitted to the air motor, e.g. with an incoming air line pressure of 80 p.s.i. the pump develops 1,600 p.s.i. fluid pressure.

This high pressure is confined to the pump, to the 20 ft. length of Teflon tube and to the spray gun. The Teflon tube is reinforced with stainless steel wire braid and has a burst pressure of 10,000 lbs. sq. in. The spray gun is fitted with a tungsten carbide nozzle to resist the erosion of abrasive paint under high pressure. At no time is there any pressure in the paint container (removed in photograph to show pump and paint agitator).

Since Hydra-Spray does not use compressed air to atomise the paint, virtually all over-spray is eliminated. So effective is this reduction in over-spray that a saving of approximately three gallons of paint out of every ten gallons used, is claimed. The unit shown is the 226-062 truck-mounted type, which is supplied with a ten U.S. gall. pail, rubber-tyred truck, 15 ft. ¼ in. i.d. air supply hose, 20 ft. ¼ in. i.d. Teflon stainless steel braided high pressure fluid hose and Hydra-Spray hand gun. Further details will be gladly supplied by Alfred Bullows and Sons Ltd., Long Street, Walsall.

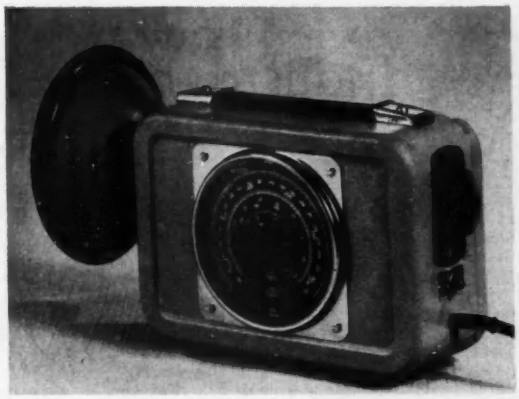


**Bullows' Hydra-Spray**

# U.S. Electronic Device "Measures" Colour

A NEW electronic device, said to be capable of detecting colour differences as low as 0·2% in textiles, paints, plastics, paper and other materials has been developed in the U.S. by a subsidiary of Royal McBee, the well-known typewriter company. Known as "Color-Eye," it is a dual-purpose precision instrument for establishing and maintaining colour control. It "measures" colours electronically and reduces them to easily-interpreted numerical values. Simple to operate, it saves considerable time on the production line by bringing colouring materials within acceptable quality control tolerances. American scientists are using it in laboratory tests on various materials to help to solve such problems as fading, weathering, tinting strength and yellowing. British enquiries regarding Color-Eye should be addressed to Royal McBee International Inc., 19 Rue du Rhone, Geneva, Switzerland.

# New Lightweight Portable Stroboscope



The "Touro Strob" measuring and observing instrument

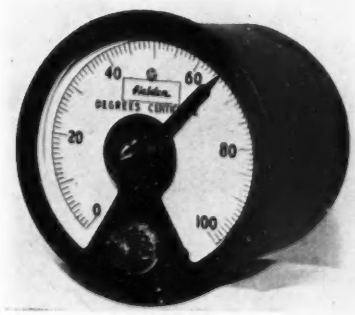
IN recent years research has emphasised the importance of stroboscopic measurement as a means to improved quality in textile goods, and interest will, therefore, be aroused in most textile sections in a new Mayer stroboscope, measuring 27×7×14.5 cm. and weighing only 4 lbs. Known as the "Touro Strob," this electro optical tachometer is simple to operate in that, after brief instruction an untrained operative can easily manipulate the device. It can be connected to any 240 volts, 50 cycles, A.C. supply and can be supplied to run off other mains voltages.

Comparative measurements and observations can be made within 45 secs. from turning on, but where precision is required it is necessary to wait 5 mins. to allow the instrument to reach operating temperature. The following speed ranges are available by immediate adjustment: (*a*) 200 - 900 r.p.m., (*b*) 900 - 3,600 r.p.m., and (*c*) 3,600 - 15,000 r.p.m. If the speed to be measured is approximately known, the correct range can be immediately selected. The projector is then directed towards the part to be measured and the pointer adjusted until the part appears stationary. The p.p.m. can then be read off the scale.

It is well known that spindle speed variation has a marked deleterious effect on yarn quality, the regular use of stroboscopic observation and any rectifying action which may be necessary after observation is believed to have virtually obviated this defect in mills where regular inspection is carried out. As described previously the leading spindle is brought to an apparent standstill, and the rest of the spindles carefully examined for rotational discrepancies. Another use in the ring-room is the tracing of yarn breakage causes by balloon observation. The potential uses of the electro-tachometer are legion—shuttle observation, roller alignment, gear setting, in short, any rotational or oscillatory movement can be dealt with accurately and efficiently. (British agents are Eric H. Bernfield Ltd., 282 Kingsland Road, London, E.8.)

# Transistorised Temperature Controller

THE first of the new "Bikini" range of transistorised instruments announced by Fielden Electronics Ltd., Wythenshawe, Manchester 22, is a precision temperature controller with a differential only 0·5°C., high calibration accuracy and high long term stability. The instrument, in a small meter type case, occupies a panel space only 4½ ins. dia. The 9-in. scale is calibrated directly in °C. or °F. and the pointer is set to the required control temperature by a small knob in the centre of the instrument; a red lamp indicates the control action. The meter type case is completely sealed and the instrument can be mounted at any angle, e.g., on a sloping control desk. Control can be at any temperature between — 200°C. and + 500°C. with a minimum temperature range span of 50°C. and there are 12 standard calibrations in °C. and °F.

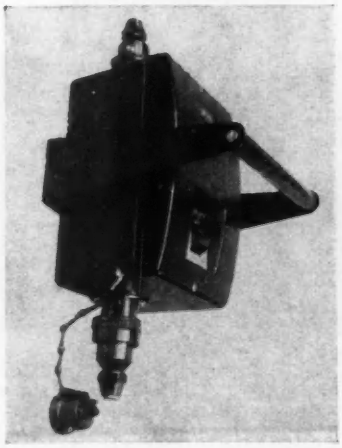



New Fielden "Bikini" precision temperature controller

A platinum resistance element used at the temperature measuring point, is housed in a robust stainless steel sheath ¼ in. dia. Ordinary connecting cable is used between the measuring point and the instrument and this can be up to 300 ft. in length without introducing errors. The control action is on/off, either electrical or pneumatic. The electrical contacts give change-over switching at 5 amps. 250 volts whilst the pneumatic valve requires 17 to 20 p.s.i. input. An interesting feature is that the electrical or pneumatic control relay can be located up to 300 ft. away from the instrument itself and only simple light duty cabling is required between the instrument and the electrical or pneumatic relay. The instrument is completely transistorised and will operate from a 12 volt d.c. supply, components operating well below their maximum rating. Practically no heat is generated and, of course, there is no "warming up" time. The low voltage and current allow handling of the instruments without fear of electrical shock and they can be used safely in hazardous areas. Units are available to provide the necessary 12 vol.s d.c. from the usual supply mains. These can be supplied for one or a number of instruments.

# Lo-Vo-Lite

SHOWN at the Manchester Industrial Efficiency and Safety Exhibition, the new Brookhirst Igranic Lo-Vo-Lite is of contemporary design eminently suitable for machine tools, precision work, laundries and other "wet" industries, drawing offices, etc., where a compact low voltage 100 watt lighting equipment is a valued asset. Robust and durable in construction the model is said to give complete safety under the most exacting conditions together with economy in current and lamps.

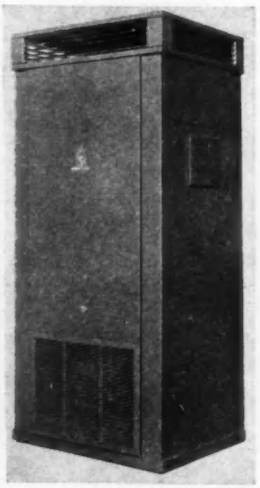


# Industrial Air Heaters

A NEW range of industrial air heaters, announced by Colt Ventilation Ltd., Surbiton, Surrey, are being manufactured initially in three sizes rated at 250,000, 350,000 and 500,000 B.T.U's. Designed by Colt engineers, these "Turbo-Static" heaters are stated to be a significant advance in oil-fired air heating. The new combustion unit, which embodies a new system of combustion air supply, has been purposely designed by Colt engineers for oil-fired air heating. A pressure blower forces air into the combustion chamber through a series of vaned slots in the inner chamber wall. The vanes impart a swirl to the air and two contra-rotating air streams are created. These air streams fulfil three distinct functions. First, the interaction between them creates air turbulence, which ensures the complete and rapid mixing of the oil mist and the air. As a result excess air requirements are reduced to a minimum. Secondly, the vortices "hold" the flame, so that complete combustion is achieved in a limited space less than 15 ins. long. Thirdly, the outer air stream forms a barrier layer which prevents the flame from impinging on the chamber walls.

This means that the size of the combustion chamber can be drastically reduced, and the chamber walls suffer no deterioration caused by flame impingement, because this does not occur.

The combustion chamber is isolated and insulated from the main air supply by two outer walls, through which the combustion air flows. In this way conduction heat loss from the chamber to the main air supply is infinitesimal and the combustion air is pre-heated to temperatures above the evaporation temperature of the oil mist. Consequently, instantaneous combustion occurs throughout the flame. The pre-heating of the combustion air and the reduction in excess air makes it possible for temperature in excess of 3,000°F. to be achieved throughout the chamber. At this temperature every particle of oil mist is evaporated so that sooting is eliminated. Approximately 5% of the combustion air enters the chamber unheated, through angled slots around the fuel injection components. This means that the injection components are cooled continuously and therefore protected from the effects of the high temperature recorded in the chamber. It also means that flame impingement; sooting; and the exposure of the nozzle and injection components to high temperatures, are eliminated.



**The Colt "Turbo-Static" industrial air heater, 500,000 B.T.U./hr. model**

# Stain Removal and Spot Cleaning

A NEW spot cleaning machine, introduced by Foster Knitting Machine Co. Ltd., Market Street, Preston, with a wide application in the textile industry, is specifically designed to effect speedy removal of oil stains on fabrics, etc., particularly during production. No steam required; the instrument operates from any conveniently placed mains plug. An atomised spray is ejected through a nozzle on to the fabric at a pressure of between 80 - 100 lbs./sq. in., and a device attached to the nozzle enables the force to be varied according to the nature of the fabric being treated.

The machine is very efficient in removing stains on wool, "Orlon," nylon and many other textile materials. It is more effective on a fabric with open mesh construction, such as knitted, rather than a closely woven cotton fabric.

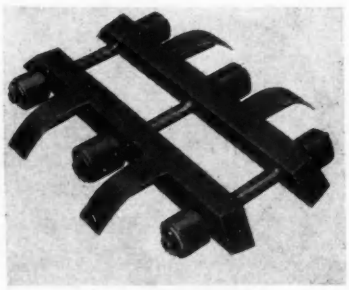
Dirt, etc. is forced through the interstices of the fabric and it is, therefore, necessary to hold a piece of absorbent fabric (i.e. a piece of towelling) behind the fabric being treated, to receive the soiling matter as it is removed. At a recent demonstration Mr. J. F. Humphreys (director, Foster Knitting Machine Co. Ltd.), said the time saving was considerable, and instanced one knitwear manufacturing company which had saved in fluids, 60% of cost, and in time, 80%. Research is continuing with regard to fluids. Trichlorethylene and perchlorethylene are both used and other firms are experimenting with fluids and soaps.

**The Foster spot cleaning machine in operation**

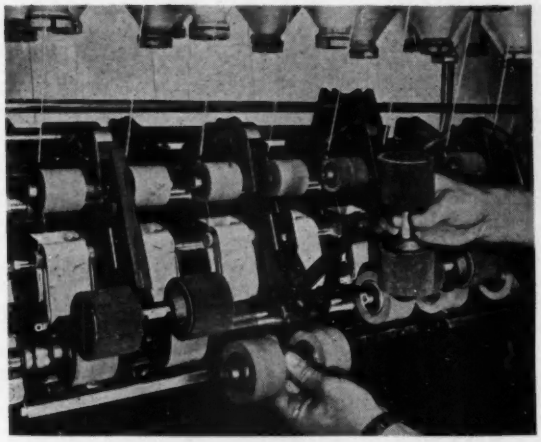
# New Six-Wheeled Trolley

THE new six-wheeled low-loading trolley recently announced by Powell and Co. Ltd., Burry Port, Carms., utilises the rectangular hollow steel tubing for the main members of the frame. A saving in weight is thereby effected without reduction in load capacity. Two sizes are in production, one 24 ins. long and 20 ins. wide with a capacity of 4,000 lbs., the other 30 ins. long and 20 ins. wide with a capacity of 3,500 lbs.

Although designed principally for the transport of heavy cylindrical loads, the trolley is also suitable for carrying heavy crates, safes, etc. It has also been found very useful for carrying and manoeuvring steel plates or sheets held in a vertical position. The trolley is only 3½ ins. high and the centre wheels are of larger diameter than the end wheels so that the trolley pivots easily and will turn in its own length. All wheels are solid steel and alloy steel roller bearings are fitted for easy running.



# New American Spinning Frame



A new highly efficient top arm with pre-calibrated, enclosed spring provides top-weighting on the new Whitin Piedmont KW

AN American system spinning frame, the "Piedmont KW," by Whitin Machine Works, Whitinsville, Mass., U.S.A., is a worsted adaptation of the company's new Piedmont cotton spinning frame. Higher production speeds, larger packages, and high quality worsted, synthetic and blended yarns are claimed for the new frame. According to J. H. Bolton, president, the machine is now in production.

The new machine utilises the Whitin long-draft two-apron system and a new top arm and weighting arrangement. The Piedmont KW is only 27 ins. wide and features streamlined design, individual side-shaft spindle drive, straight line spinning, and two balloon control rings. All gearing is enclosed in the head end, and the machine has a built-in waste removal system. A new, efficient top arm with internal pre-calibrated springs for supplying weight to the top roll has been designed.

Instantaneous control of ratch or spread between the middle and back roll is also available. Maximum ratch is 9¼ ins. This drafting arrangement will handle fibres from 1½ to 8¾ ins. with appropriate ratch settings and roll diameters.

Mill and laboratory tests are said to indicate that increase in production ranging from 20 to 30% may be secured. Normal gauges will be 4 to 4½ ins., and ring sizes can be supplied from 1½ to 3½ ins., depending upon the gauge of the frame. Traverses up to 11 ins. may be used. (U.K. agents: A. E. Aspinall, Manchester.)

# Non-Wetting Humidifier

THE new "Aerosolette"—a compact humidifier produced by Aerosol-Turbo Ltd., 14 Cross Belgrave Street, Leeds 1, whose non-wetting industrial humidifiers are already well known—will undoubtedly interest all firms requiring a highly efficient, portable unit. Lack of the correct amount of moisture in the air can have a deleterious effect on the protective mechanisms of the body and, quite apart from health considerations, excessively dry heat can cause physical damage to the contents of any room by "drying out," and may cause difficulties and financial losses during the storage or processing of materials (through differentials in weights or quality, reductions in tensile strength, increases in waste and dust, etc.).

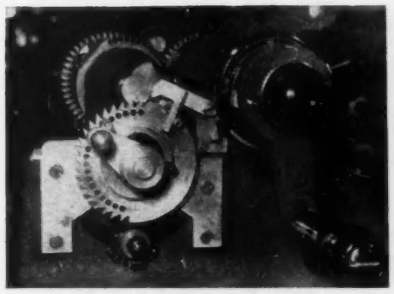
Germicides, insecticides, deodorants, etc., can all be dispersed in the atmosphere with water, at the rate of up to one pint per hour, as micro-aerosols so small that they are "dry" in effect; even a glass held near the outlet of the "Aerosolette" will not become wet. There can be few commercial or industrial firms who could not use an "Aerosolette" beneficially and profitably. The unit will maintain a constant humidity in laboratories, workrooms, etc., and stands only 10½ ins. high, weighs only 10 lbs. It has a stove-enamelled polychromatic silver-grey finish and uses the same amount of electricity as a 60 watt bulb. Safe and quiet in operation, optional extras include time or humidistat controls, a neat stand, and a directional cowl.

"Aerosolette" portable non-wetting humidifier

# Multi-Fold Numbering Unit

NUMBERING irregularly-sized batches of tickets has often entailed a wastage of either tickets or labour. For example, to switch from printing eleven-ticket batches the operator of a Tickopres machine has had to unscrew the eleven-fold numbering-unit and replace it in turn with units imprinting consecutive numbers thirteen-, seventeen- and nineteen-fold. These time-wasting operations have now been eliminated, it is claimed and, following experiments in clothing factories in Leeds and London, Tickopres Ltd. are now able to fit to users' existing machines a multi-fold numbering-unit which prints six-figure numbers consecutively in any sequence up to twenty-fold.

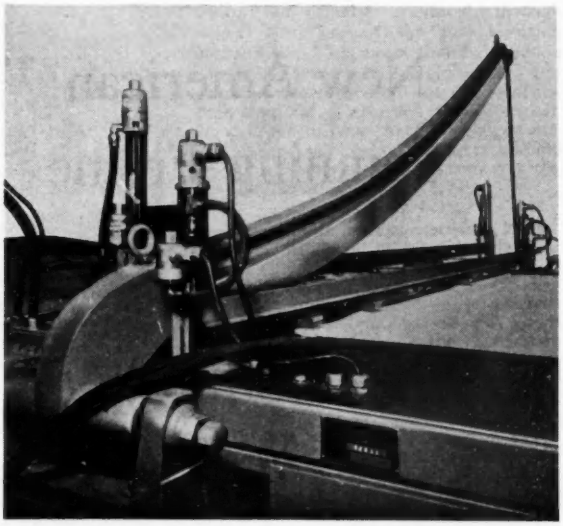
Known as the Tickoselect unit, this new numbering-unit is re-set simply by moving a lever around a numbered dial-like disc at the side of the machine. To change the fold, therefore, takes only two seconds instead of the several minutes needed to change numbering-units. Tickopres Ltd. point out that, because a series of numbering-units are now replaced by one, the innovation will also substantially reduce capital costs.



# Automatic Blanket-Cutting Machine

A WELL-KNOWN U.S. company—Leaksville Woollen Mills—recently installed a new machine reported to save several operators in handling wide blankets. The machine pulls the blanket out to the desired length, cuts across with a 1,200-lb. guillotine knife, folds the cut blanket once or twice and stacks the folded blankets neatly one on top of the other to a height of 4 ft. or more. The production of the machine is 21 blankets/min. or about 10,000 per day if operated continuously; this production normally requires eight operators working by hand.

The guillotine machine is fully automatic requiring no attention except to bring material to the machine and remove stacks of cut blankets. Mr. J. L. Moorehead president, Leaksville, and Mr. J. Wilson, vice-president, worked closely with Sjostrom Machine Co., Boca Raton, Florida, builders of the machine in the engineering and development. The guillotine machine will be made available shortly to other blanket manufacturers.



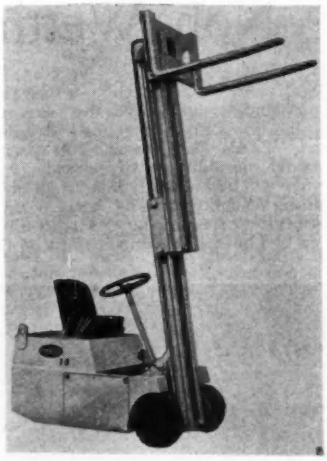
**Fully automatic, this new Sjostrom machine is said to cut down labour costs considerably**

# Mobile Dust-Cleaning Units

WHEREVER large quantities of dust—always a hindrance to production and a danger to health of employees—prevail, there lies a need for a reliable and efficient suction cleaner. It is a problem in the textile industry where the minute particles of "fly" are difficult to keep down. Since 1926 the Tellus Super Vacuum company has concentrated its efforts on the commercial, medical and industrial field, and the four models at present in production are all designed to undertake a difficult task.

With the Tellus cleaner dust is drawn in through the nozzle and deflected down into a steel bin leaving the air to escape through an exhaust filter. In this manner there is no loss of suction power and the dust container is easy to empty. All models are of an upright type with one, two or three motors according to size and power required. Models G.72 and 73, with two and three motors respectively, are of particular use in the textile industry and the range of accessories ensures that dust can be removed from the innermost part of machinery equipment or from the highest girder.

## New Fork-Lift Truck



EQUIPPED with three forward and three reverse speeds, the Forager 15 fork-lift truck made by A. Hirst and Son Ltd., is a new battery-operated model of sturdy construction and easy operation. Designed with a lifting capacity of 15 cwts., the overall height is—raised 11¼ ft., lowered 6½ ft. for 9½ ft. lift—and the overall width 3 ft. The 3½ ft. forks are adjustable from 8 ins. to 3 ft. outside and the tilt 3° forward to 7½° back. A heavy duty traction motor supplies the power and the machine has rear wheel drive through heavy duty worm reduction; the lifting power is obtained from a separate pump motor unit and control valve. The brake is a heavy duty hydraulic type—foot or hand operated—acting on the front wheels. The truck—equipped with a 210 A/H 24 volt, traction-type battery—has a road speed of 1½ to 4 m.p.h., and a lifting speed of 15 - 20 ft./min.

THE TEXTILE
COLOURIST & FINISHER

# Crease-Resisting Theory: Treated Textiles

*With processes in current use there is considerable evidence for some form of molecular entanglement which embraces hydrogen-bonding, complex formation and the production of co-valent cross-linkages, but it should not be assumed that the last-mentioned is the one and only explanation of the crease-resisting phenomena*

By J. T. MARSH, M.SC., F.R.I.C., F.T.I., F.S.D.C.

AT the present time, it is hardly possible to find a drapery establishment which does not offer crease-resisting fabrics or garments; these are sold throughout the world. What is perhaps more surprising, is that it is hardly possible to open a textile journal which does not contain an article on some aspect of the crease-resisting process. There is renewed interest in the precise mechanism whereby the effect is produced, but many authors in their enthusiasm appear to ignore earlier work. The crease-resisting process was patented in 1926 as the result of the work of Foulds, Marsh and Wood in the laboratories of Tootal Broadhurst Lee Co. Ltd., Manchester. The order of events was first, the crease-resisting effect on cotton with phenol-formaldehyde in presence of alkali, soon followed by crease-resisting effects with urea-formaldehyde in presence of acid; observations on the anti-shrink properties of the treated goods were noted, as were improvements in the physical properties of regenerated cellulose a little later. When the process was developed commercially, both cotton goods and rayon goods were marketed. The actual order of events differs somewhat from that given by some American authorities who were 3,000 or 4,000 miles away at the time.

As early as 1927 it had been demonstrated by the writer that phenol-formaldehyde resin was formed inside the fibre, and later work by Battye and Alexander showed a similar state of affairs with urea-formaldehyde; a recent paper on the location of the resinous product by Marsh (Text. Mfr., 1959, **85**, 35) brings this topic up to date. Although from the very beginning of the process the criterion of success was to form the resin inside the fibre, this could not be regarded as a satisfactory explanation of the mechanism of the effect; it explains *how*, but not *why*. Before dismissing it, however, attention should be drawn to the suggestion of Quehl (Textilber., 1939, **20**, 76) that crease-recovery was due to increasing the amount of amorphous material in the fibre; this will be discussed later.

### Co-valent Cross-links

It should be recalled that at the time of the original crease-resisting invention, there was little precise knowledge of the constitution and molecular structure of cotton or wool; it was known that cotton creased and wool did not, but there was no scientific explanation. An important publication by Meunier and Guyot (Rev. gen. Coll., 1929, **7**, 53) discussed the old reaction of formaldehyde with cellulose and suggested that the reduction in water-imbibition was due to methylene-bridges between adjacent chain-molecules of cellulose. This was a very important and far-reaching speculation, but it must be remembered that Meunier and Guyot did not relate the amount of combined formaldehyde to the water-imbibition; indeed they never demonstrated the presence of formaldehyde in any of their treated products. There was no mention of crease-recovery in their publications; nevertheless, this was an important suggestion for it marks the start of the cross-linking theory.

In actual fact, crease-resisting cotton had been produced by Barrett in the Tootal laboratories in 1919, by direct combination with formaldehyde but the goods were so embrittled as to be of no commercial value. Much work has been done subsequently on the reaction between cellulose and formaldehyde, and one of the latest publications is that of Marsh (J.S.D.C., 1959, **75**, 244) who had previously discussed the subject in his book on Textile Finishing (Chapman and Hall; London; 1946); there is also a recent survey of the literature by Roff (J.T.I., 1948, **49**, 646).

The formulation of some sort of cross-bonds during the vulcanisation of rubber had already been made by Prins (Chem. Weekblad., 1918, **16**, 64) but the pioneer work in textiles was undoubtedly due to the researches of Astbury and Speakman on wool in the early 1930s from which it became clear that much of the elastic recovery of wool was due to the presence of salt-like linkages and cystine bridges between the main chains (Fig. 1). During a survey of the

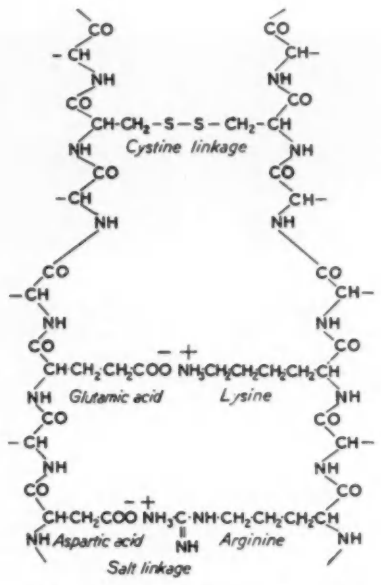



**Fig. 1. The grid structure of wool keratin**

reactions which were then known to give crease-recovery effects on cotton and rayon, the writer in the winter of 1930, came to the conclusion that bifunctional or polyfunctional compounds were necessary, even if the precise chemistry of the process was somewhat obscure. For various reasons the conception of the co-valent cross-linkage between cellulose and the resin did not attract much attention until revived by Cameron and Morton (J.S.D.C., 1948, **64**, 329).

These authors consider that with a resin content of about 15%, only 1% is active in forming definite cross-linkages, and the remainder is deposited interstitially in the amorphous regions of the fibre, but the resin of both categories is effective in modifying fibre properties. They do not state whether crease-recovery is modified by the 14% of interstitial resin, nor do they provide evidence for their conclusion about the "active" 1% of resin. Although they clearly state that the true picture of the crease-resisting effect is probably between the extremes of the simple cross-link and the interstitial resin, yet the greater part of their paper is directed to arguments in favour of cross-bonds. Like Meunier and Guyot, they attach considerable importance to water-imbibition but many chemists would probably agree that the degree of swelling in water is not necessarily related to, or even indicative of, cross-linking. Similarly with regard to solubility in cuprammonia, where one should remember that solvation is preceded by complex-formation, there are many mono-functional reagents which give insoluble derivatives, thus minimising the argument that insolubility denotes the existence of co-valent cross-linkages. With only dimethylol urea and cellulose, there are at least nine possible modes of reaction, as pointed out by Nuessle, Fineman and Heiges (Text. Res. J., 1955, **25**, 24); Head (J.T.I., 1958, **49**, 345T) has mentioned eight possible compounds from glyoxal and cellulose, hence it is unwise to postulate one single method of reaction for polyfunctional reagents.

## Molecular Entanglements

In seeking for some simple explanation of the crease-resisting phenomenon, it is all too easy to suggest chemical combination with the resin; such a possibility was not ignored by the inventors of the process. There were many factors to be taken into consideration, however, and these were the occasion of much profound thought. It was part of the folk-lore of crease-recovery that when cotton fabric was dried in a vacuum desiccator, it showed good recovery from the "clenched-fist" test. This had been demonstrated independently by Barrett and by Wood about 1919; the effect soon disappeared as moisture was absorbed and it was obviously not due to the formation of a new chemical compound, but to hydrogen-bonding which was not then postulated.

As previously mentioned, Barrett had also shown that crease-resisting cotton could be prepared by combining cellulose and formaldehyde, but with considerable damage to the cotton. It seemed, and still seems, a reasonable explanation that cellulose methylene ether was formed but it was shown by Wood, (J.S.C.I., 1931, **50**, 411) that the type of product is largely determined by the amount of moisture in the cellulose at the time of reaction; hence cross-linkage does not necessarily produce either crease-resistance or low water-imbibition.

The first crease-resisting effects with resins were from treatment with phenol-formaldehyde under alkaline conditions; it is not easy to imagine an orthodox type of compound here. When phenol alcohols are applied to cellulose under acid conditions they do not produce crease-resisting effects and the type of "Novolak" formed is thermo-plastic. Good crease-resisting results were produced with urea-formaldehyde under acid conditions but the rather too obvious idea of etherification was discounted by the fact that the cellulose could be recovered unchanged when the resin was removed with either acid or alkali; any combined formaldehyde found in samples from which the resin had been removed was generally less than 0·25% which was quite inadequate to produce crease-resistance. It was found that crease-recovery was removed with the resin.

Another observation to be taken into consideration was that moderately good crease-recovery could be obtained by applying urea-formaldehyde and drying but not heating; the product formed was soluble in water. Hence the main effect of heat is to insolubilise the resin although there is also some improvement in crease-recovery. Allied to the above observation was the work of Marsh and Battye in 1929 with various inorganic compounds capable of forming colloidal masses; borates, silicates and stannates were examined and found to give reasonably good crease-recovery on cotton but the effect disappeared on washing. The work of later investigators has been described by Marsh (Textile Finishing; Chapman and Hall; London; 1946, pages 405, 429 and 432), who suggested that this type of crease-recovery was caused by complex-formation.

Another thermosetting resin which was examined was that from acetone and formaldehyde under alkaline conditions. This gave reasonably satisfactory crease-resistance but with some discoloration and much embrittlement; the fastness to washing was poor. Comparatively little has been published about the acetone formaldehyde resin but the possibility of the formation of a vinyl ketone which can combine with cellulose is very real, in addition to crease-recovery because of the presence of a resin inside the fibre. (Cf. U.S.P. 2,524,399 of 1950 with divinyl sulphone.)

Not all resins give the crease-resisting effect even when formed inside the fibre; mention has already been made of the lack of crease-resistance from the thermoplastic phenol formaldehyde products in contrast to the thermosetting phenolic resins. Thermo-plastic resins of the vinyl type or the acrylates failed to give crease-recovery when formed inside the fibre by the Kistler transfer technique carried

out by Marsh and Potter. This type of work has also been discussed by Nuessle, Fineman and Heiges (Text. Res. J., 1955, **25**, 24) who confirmed the ineffectiveness of many thermoplastic polymers in producing crease-recovery; even the highly polar polymers such as polymethacrylamide are not successful, but where there is a reactive $—NH_2$ side-chain, a subsequent treatment with formaldehyde results in good crease-recovery.

In general, the crease-resisting effect does not seem to be due merely to the treatment of cellulose with an internal filler. In the case of cotton fabrics, the improvement in crease-recovery with added resin increases logarithmically up to 10 to 12% of resin, after which there is little further improvement; it is possible, however, to get as much as 30% of added resin inside the cotton fibre by special methods of impregnation and yet the fabric is still soft and supple. (With phenol formaldehyde, 40% of added resin has been produced inside the fibre.) These figures compare reasonably well with the proportion of so-called amorphous cellulose in cotton.

In connection with the location of the resin, it was shown by Astbury and Marsh in 1937 that the crystalline structure of cellulose was not penetrated by the amino-aldehyde condensation product. The rise of acetate rayon in the textile field provided some evidence that the presence of side-chains alone could give a product of improved crease-recovery and which did not depend on any type of junction between the chain molecules themselves. These facts were under constant review against the background of the grid-structure of wool and it was concluded that the crease-recovery effects could be explained by some form of molecular entanglement which was not limited to the simple co-valent cross-linkages, although it included them, but embraced other possibilities such as hydrogen-bonding and also complex-formation.

These ideas were represented in model form by a system of differently coloured lights for the various atoms in the molecular structures of cellulose, wool and crease-resisting cellulose (Fig. 2), the chain-molecules being moved by switches and solenoids. In this manner simple demonstrations were made of natural creasing, natural uncreasing and the effect of the resin entangling the cellulose chain-molecules to impart crease-recovery similar to wool. These working molecular models were the object of great interest at trade exhibitions in Manchester, London and elsewhere in the autumn of 1938.

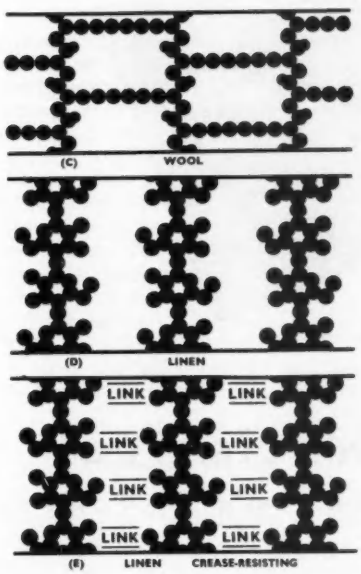



**Fig. 2. Illustration of the working models of 1938 with the following legend. "Comparing the molecular structures of wool and linen it is clear that, although both are composed of long chains of molecules lying side by side, in the case of wool there are bridges or links between these chains to support and hold them in position. In the case of linen there are no such bridges. Diagrams C and D illustrate this important difference. Diagram E represents the change that takes place in linen when it is rendered crease-resisting by the introduction of a synthetic resin into the fibre. This resin, in accommodating itself to the molecular structure of linen, provides a bridge between the chains of molecules, thus giving the fabric the resilience it ordinarily lacks (Marsh; 1938).**

A certain amount of patent litigation was encountered in Europe as discussed by Marsh in the Mather lecture for 1957 (J.T.I., 1957, **48**, 370P) and during these proceedings various views were challenged by some of the most astute brains in Europe; hence it was unwise fully to disclose the theory and practice of the treatment. Nevertheless, the processes of the law sharpened and clarified various views as to the actual mechanism of the crease-resisting effect. Many of the advantages of the process had been given in a short memorandum compiled by the writer in 1932 (J.S.D.C., 1932, **48**, 295) but a full discussion of the theoretical background took place in a lecture to Leeds University Textile Society in 1944 and, to a less extent, to the Institution of British Launderers (Silk Journal and Rayon World, 1945, **21**, 33).

The entanglement theory was presented in some detail in pages 426 to 434 of the author's book on Textile Finishing (Chapman and Hall; London; 1946) but before it actually appeared in May 1947 there had been a stimulating discussion on a paper by Landells (J.T.I., 1946, **37**, 317P) when various views were expressed on the possibilities of the co-valent cross-link, on the one hand, and the mechanical reinforcement by internal production of a suitable resin, on the other hand. It seems clear that the introduction of cross-linkages, no matter their nature, will prevent the irreversible slipping of adjacent chain-molecules during extension of the fibre and increase its elastic recovery from deformation. Molecular slip, of course, only occurs within the so-called amorphous regions of the cellulose; the application of stress may alter the relative disposition of crystallites but has no appreciable effect on their internal arrangement.

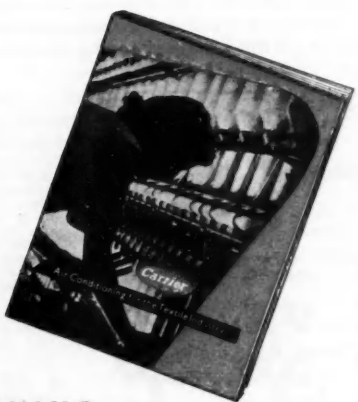
## Modern Views

In connection with the treatment of cellulosic fabrics with resinous condensation products, generally amino-aldehydes, there is still considerable discussion as to the precise nature of their action. Argument appears to centre on the question of whether these agents modify the properties of cellulose because they actually form primary valency linkages between individual chain-molecules. It is unwise for anyone to make absolute statements about the mechanism of the reactions; there are many different compounds and the experimental evidence from one of these does not necessarily apply to the whole class. Furthermore, certain proof of cross-linkages based on chemical evidence is most difficult to obtain, and indeed, much of the evidence is based on the inferences from physico-chemical data. No degradation processes have been applied to the so-called cross-linked cottons or rayons with a view to isolating the formals of glucose or cellobiose, nor indeed have these been synthesised as "model compounds" which might illuminate the situation. On the other hand, the acetals of ethylene glycol were prepared in 1950. An important paper by Head (J.T.I., 1958, **49**, 345T) demonstrated the presence of diacetals in reduced and oxidised "glyoxalised" cellulose, thus producing the most direct evidence yet obtained of the presence of co-valent cross-linkages between cellulose chain-molecules.

In reviewing the modern position and covering the past 10 years, a convenient starting point may be a publication by Gagliardi and Gruntfest (Text. Res. J., 1950, **20**, 180) who drew attention again to the old idea of the two possibilities of strong physical bonds or primary valency bonds between the chain molecules of cellulose. Some data of

# IS 'CARRIER' AIR-CONDITIONING A PART OF YOUR RE-EQUIPMENT PLAN?

Air Conditioning is planned by "Carrier" as essential production equipment — perfected during our 40 years association with the British Textile Industry. Our guide book "Carrier Air Conditioning in the Textile Industry" will help you decide. May we send you a copy?




Carrier

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minor interest demonstrated the relation between yarn recovery from extension and fabric recovery from creasing.

| | Elastic Recovery | |
|---|---|---|
| | Yarn 5% Extn. | Fabric Creased |
| Untreated rayon | 15% | 40% |
| Resin-treated .. | 60% | 75% |

Cooke, Dusenbury, Kienle and Lineken (Text. Res. J., 1954, **24**, 1,015) illustrated the effect of resin treatment of rayon fibres by means of stress-strain curves, and showed that this effect was carried through from filament to fabric as might be expected. These authors stated that there is little doubt that the amino-aldehyde resins are actually formed within the cellulose fibre, for in addition to the evidence from dye-staining technique, they point out that the maximum dimension of trimethylol melamine is 12·7 Å and that the average pore size of viscose rayon is 40 to 60 Å; the molecule of dimethylol urea, of course, is smaller than that of trimethylol melamine. They also claim to have prepared a pentamer of urea-formaldehyde, i.e. five molecules of dimethylol urea condensed together, and this also penetrated to the inside of the cotton fibre. Cooke and his colleagues confirmed by x-ray analysis that there is no alteration to the crystal lattice of cellulose after crease-resisting; thus the resin is not formed within the crystallite and it is most probable that it is deposited in the amorphous regions of the fibre, as suggested many years previously.

In considering the possibility of chemical reaction between cellulose and the resin, it was thought that infra-red spectro-photometric measurements might reveal some evidence, and as a result it was concluded that the spectral changes were suggestive of a reaction between melamine-formaldehyde and cellulose through ether formation. It would be very useful to know what changes are seen with cotton and rayon which have been made crease-resistant with phenol-formaldehyde, or with urea-formaldehyde which has not been rendered insoluble by heat.

Cooke and his colleagues have also discussed the ease of hydrolysis of crease-resisting textiles compared with the cellulose methylene ethers, from which it has been argued that the amino-aldehyde condensation products do not react with cellulose in the same way as formaldehyde itself. They point out that the cellulose-formaldehyde reaction requires more highly acidic conditions, and may therefore require more highly acidic hydrolysis; urea-formaldehyde hydrolyses more readily than melamine-formaldehyde. The rate of hydrolysis may be expected to differ according to the chemical groups linked to each other through the ether group. Hence the reaction of the amino-aldehyde with cellulose to form a co-valent bond is a possibility, in their opinion, although the evidence from acid hydrolysis indicates otherwise. Even though the possible interactions include resin formation, hydrogen bonding and van der Waals' forces between the resin and cellulose, they are of the opinion that crease-recovery is primarily obtained by chemical reaction within the fibre by forming bridges or cross-links between adjacent chain molecules.

Some further work was done by Lineken, Davis and Jorgensen (Text. Res. J., 1956, **26**, 940) during the course of which they gave the following data for the treatment of cotton with 8% of a partially methylated methylol melamine.

| Effect of Resin on Weft of Cotton Fabric | | | | | |
|---|---|---|---|---|---|
| | Ex-tension | Break-ing Load | Re-covery | Elasticity at 10% Extn. | Rip |
| Untreated | 22·2% | 31·1 lbs. | 46% | 75% | 0·88 |
| Treated .. | 16·0% | 22·3 lbs. | 74% | 89% | 0·64 |

It will be seen, as usual, that crease-recovery and recovery from elastic extension are improved as a result of the treatment, but that breaking load, extension at break and ripping strength are all reduced.

Measurements of the infra-red transmission spectra were made on transparent sheets of regenerated cellulose. In the case of treatment with formaldehyde only, the evidence strongly supports the formation of cross-linkages by methylene ether formation. There was also some evidence from a mixture of mono and dimethylol urea, trimethylol melamine, and a partly methylated trimethylol melamine, indicating new bonds but the authors are careful to point out that this evidence does not by itself show that the resins form cross-links with the cellulose. The argument is advanced that because the hydrolysis of the treated cotton with phosphoric acid removes 10% of the applied resin and 80% of the crease-resistance in 5 mins., and 36% of the resin and 95% of the recovery in 10 mins., it is indicated that cross-links are broken before the resin is removed. The discussion, however, is not generalised but limited to acid hydrolysis and to melamine-formaldehyde.

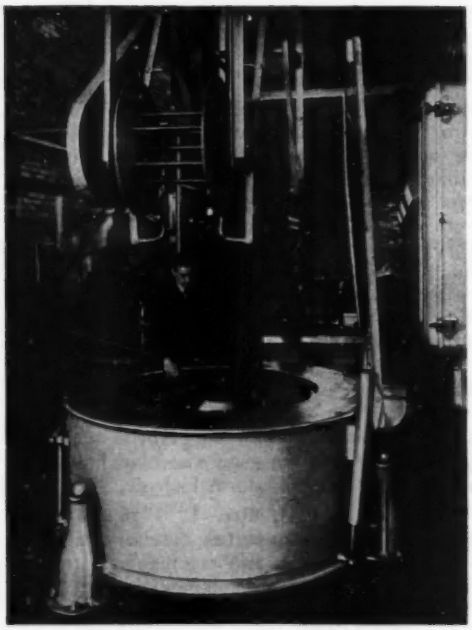
Steele and Giddings (Text. Res. J., 1956, **26**, 116) examined the load-elongation properties, the elastic stiffness, and stress relaxation of cotton and rayon fabrics treated with dimethylol urea and with monomethylol urea. They expressed the view that as the two compounds are equally effective with rayon, but dimethylol urea is better with cotton, the difference in behaviour is largely due to a difference in orientation of the two fibres, and more particularly to the presence of helical fibrils in cotton. Resin side-chains which are derived from monomethylol urea are assumed not to interfere with the fibrillar motion of cotton; with viscose rayon, the deformation of the sample is not limited by the presence of stiff fibrils, so that the co-valent linkages postulated with dimethylol urea, are no more effective than the side-chains from monomethylol urea and which are believed to be effective through hydrogen bonding or steric hindrance.

One of the most important papers on the possible mechanism of crease-recovery is that by Nuessle, Fineman and Heiges (Text. Res. J., 1955, **25**, 24) who pointed out that it is obviously most difficult to distinguish between hydrogen bonding and the co-valent cross-link in crease-resistant fabrics. It is unwise, as might be expected, to regard monomethylol urea as monofunctional in the actual reaction as distinct from theoretical probabilities, for when some formaldehyde is split off there will be a little dimethylol urea formed. Furthermore, there is the possibility of the formation of cellulose carbamate followed by cross-linking.

**Cell.O.CO.NH.$CH_2$O.Cell.**

Nuessle and his colleagues also drew attention to the dangers of arguments about insolubility in cellulose solvents as part of the case for cross-linkages, for it is possible to prepare samples where there is little relation between crease-resistance and insolubility. As is well known, hydrogen bonds alone are quite capable of altering the solubility of an assembly of chain-molecules. Hence it would appear that intermolecular bonding takes place through hydrogen bonds and there is no need to postulate the co-valent cross-link; much of the thinking about the process is dominated by the fact that most of the crease-proofing reagents are prepared from formaldehyde, and as some of this is liberated during the heating process, there are possibilities of cross-linkage.

During the past 5 years there has been great activity with bifunctional reagents for crease-proofing; these reagents cannot form thermosetting resins but only linear polymers, and they generally display a greater tendency to



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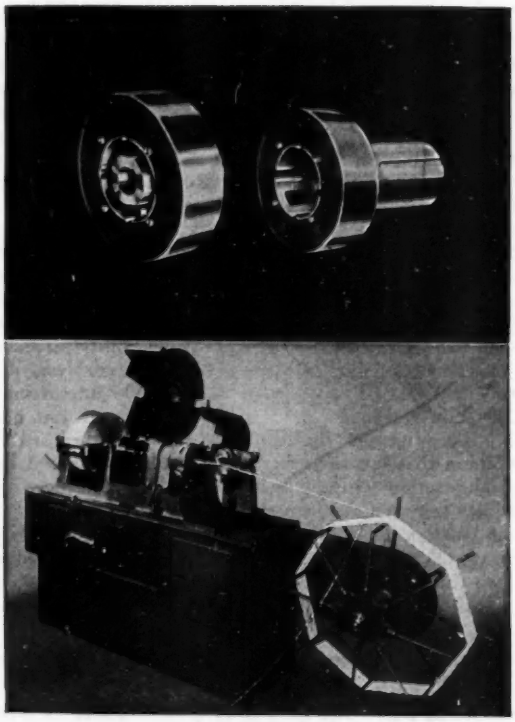

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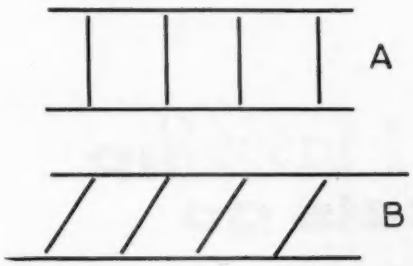



**Fig. 3. Simple diagrammatic representation of the effect of cross-links or entanglements (*A*) which hinder the flow of the structural units when strained or deformed (*B*) and store up the energy to provide crease-recovery (compare the self-closing door). The same entanglements will also reduce the extensibility of the fibre**

react with cellulose than with themselves. In addition to the amino-aldehyde products such as dimethylol cyclic ethylene urea and dimethylol triazone, there are epoxy compounds, acetals and urethanes. All these compounds provide additional evidence in favour of the co-valent cross-link but none of them provide proof of its existence, nor do they destroy the arguments in favour of entanglements by hydrogen bonding with other compounds. Mention should be made of the work of Frick, Kottes and Reid (Text. Res. J., 1959, **29**, 314) who showed that the monofunctional methylol derivative of N-methylethylene urea does not impart crease-resistance, in contrast to dimethylol ethylene urea.

It has long been recognised that the introduction of new linkages, even of ill-defined character, means that the fibres cannot stretch as readily to relieve the strain (Fig. 3); hence they break more readily in many circumstances, particularly with cotton where the load is not distributed evenly because of the greater proportion of regions of high lateral order. Not surprisingly, attempts have been made to overcome this problem by using longer and more elastic cross-linkages but without success; there seems to be a definite relation between improvement in crease-recovery and reduction in tear strength, and a longer linkage only gives poor recovery, which is to be expected if it is loose enough to allow molecular rearrangement under stress. In any case, it should not be assumed that a small molecule must give a short cross-linkage, for there is always the possibility of dimer or trimer formation. Furthermore, there may be good reasons for believing that the distance between the cross-linkages is more important than their length; this is confirmed by recent work on crease-recovery in the wet state.

In just the same way as there are dangers in wide generalisations in connection with co-valent cross-linkages, so there is a tendency to attribute the different response of cotton and rayon to their amorphous structures. An important new observation mentioned by Du Pré (Text. Res. J., 1959, **29**, 151) is that the growth layers of cotton may be bound together by the chemical reagents which impart crease-resistance. Tripp has demonstrated that crease-resisting cotton does not fibrillate on wet-beating.

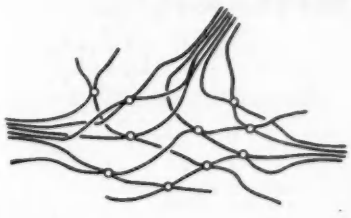


**Fig. 4. Diagram of the network structure of cellulose with junction points in the amorphous regions, according to Hermans**

In reviewing the mechanism of crease-recovery, therefore, greater attention should be paid to the differences in gross and fine structure of cotton; there are possible effects due to the shape of the fibre, the convolutions and reversals, to the primary and secondary walls, the helical arrangement of the fibrils, as well as to the existence of the lamellae previously mentioned. Even in the fine structure, there are dangers of attributing too much simply to differences in the proportions of amorphous cellulose; there is the size of the crystallite, the length of the chain-molecule, the ratio of crystalline to amorphous cellulose, and many other factors to be taken into account. Although the quantities of reagents used for the optimum effect with both cotton and rayon bear the same relation when calculated in terms of the amorphous components of the two fibres, the crease-recovery of cotton is improved logarithmically and more readily than that of rayon where there is a linear relation between reagent and recovery; it may be that this difference depends on fibre structure.

In summarising the present position, attention should be drawn to the importance of the hydrogen bonds. The crease-recovery of dried cotton is probably due to hydrogen-bonding at the junction points in the amorphous cellulose (Figs. 4, 5 and 6), but these bonds are broken again on the absorption of moisture. With the periodate oxycelluloses—the so-called dialdehyde cottons—the crease-recovery is maintained at atmospheric humidity and restored on drying after wetting (Reeves; private communication); this may be due to the superior strength of the —CO groups over the —OH groups in respect of hydrogen bonds. (Crease-recovery is further improved by cross-linkages.) As all the conventional processes for crease-recovery involve treatment at temperatures around 150°C., one is tempted to wonder to what extent crease-recovery depends on hydrogen bonds which are locked into the appropriate positions by chemical or physico-chemical means. The "ageing effect" after the finishing process is also probably associated with hydrogen-bonding.

Crease-recovery can also be produced by complex-formation; at the present time, metallic salt catalysts are very popular in the finishing works because they are stated

(*continued on page 564*)

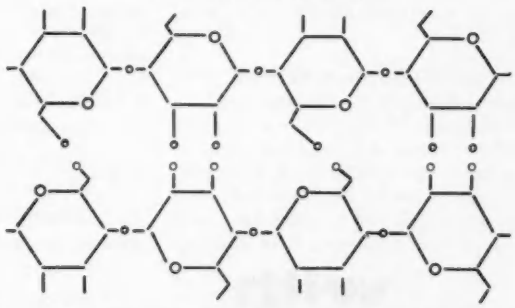


**Fig. 5. Diagram of adjacent chain molecules of cellulose showing the possibility of hydrogen bonds between hydroxyl groups**

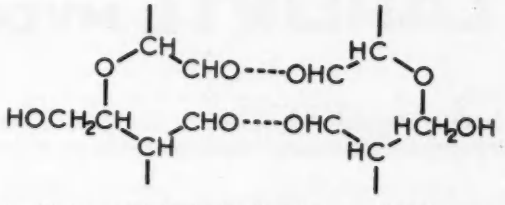
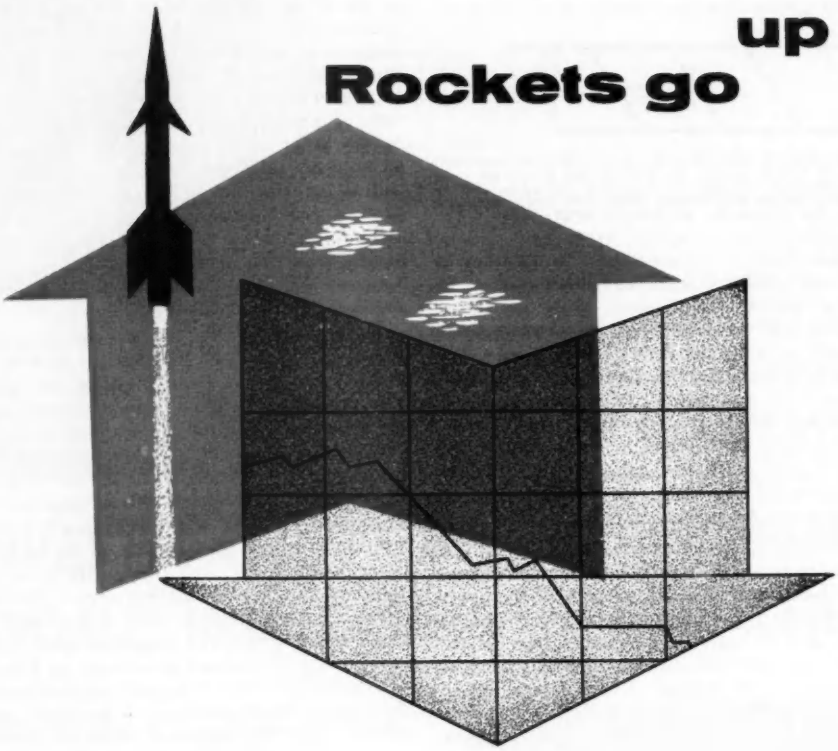



**Fig. 6. Diagram of hydrogen bonding between aldehyde groups in oxidised cellulose**



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# Recent Developments in Wool Dyeing*

*Advantages offered by a continuous dyeing process include shorter dyeing times, minimum handling, fastness properties equal to those of normal dyeing methods, complete levelness, and better coverage of tippy wools*

By W. BEAL†

WHEN dyeing problems are mentioned, many people instinctively think of the dyeing of the newer synthetic fibres or their blends and assume the natural fibres such as wool and cotton now present very few difficulties to the dyer. Whilst it is true that a wide palette of shades can be dyed on wool, it would be wrong to say that there are no remaining problems. Brighter shades and better fastness properties are constantly being required and these present a problem to the dye manufacturer. On the other hand, there is a demand for easier or quicker dyeing processes and for methods of dyeing which will leave the wool in a better condition than is obtained by some conventional dyeing methods. This paper deals under three main headings with recent development work by Geigy in this field.

## Continuous Dyeing

The principal challenge still open to the wool dyeing industry is to develop a continuous method of dyeing. Several methods have been proposed in the past but to my knowledge there has never really been a satisfactory continuous dyeing method for wool. For the past three to four years, Geigy have been working on this idea, and our most recent thoughts were presented by Dr. H. R. Hirsbrunner (Geigy, Basle) to the recent International Symposium in London. In fact we have devised two systems, one for slubbing and loose wool, and the other for piece goods. Both are based on the same basic idea, but require different machinery because of the mechanical problems involved.

One of the big drawbacks to continuous dyeing methods for wool previously has been that there has not been available any means of getting sufficient fixation of the dye to the fibre in the very short time which is required for continuous processing. We believe that we have been able to overcome this, by the use of special chemicals and we have thus been able to make use of a technique which has been proposed on many previous occasions, i.e. first pad the material with dyestuffs, plus suitable assistants. Second fix by steaming or drying, and then run into an acid fixation bath, followed by a washing-off process. The apparatuses required are shown in the three diagrams. The advantages offered by a continuous dyeing process may be summarised as follows:—

**(1) Short dyeing times.**
**(2) Simple dyeing method, easy conversion of normal dye recipes.**
**(3) Minimum handling of the material.**
**(4) Better spinning properties of slubbing and loose material.**
**(5) Fastness properties equal to those of normal dyeing methods.**
**(6) Complete levelness.**
**(7) Better coverage of tippy wools or wools of different quality and fineness.**

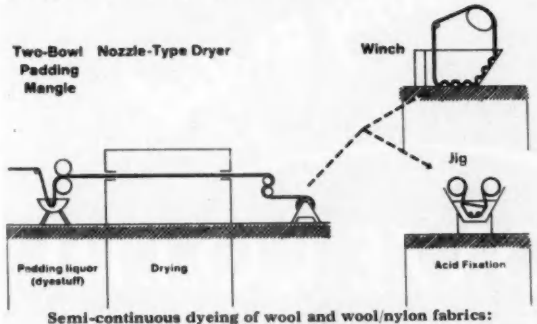
As regards the hosiery trade, we have not yet worked out a satisfactory process for yarn, or given serious consideration to knitted fabrics. Both these important subjects will receive attention but we are first trying to deal with those materials most easily amenable to continuous dyeing systems.

## Solvent Assisted Dyeing

The ideal solvent should be cheap, have little odour and be non-toxic. It should also have low water-solubility and be a good solvent for most wool dyes, but it should not adversely affect the wool fibre. Over 200 such compounds were examined and for many

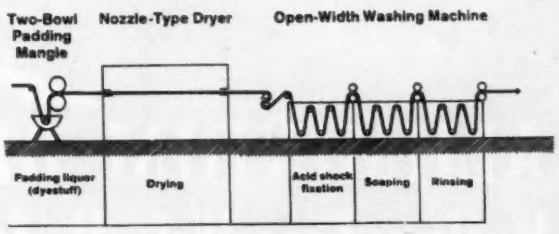
* *Summary of a paper given recently to the Guild of Technical Dyers at Leicester.*

† *Geigy Co. Ltd., Rhodes, Middleton.*




**Semi-continuous dyeing of wool and wool/nylon fabrics: pad-dry/acid fixation process**

(below) **Continuous dyeing of wool and wool/nylon fabrics: pad-dry/acid fixation process**



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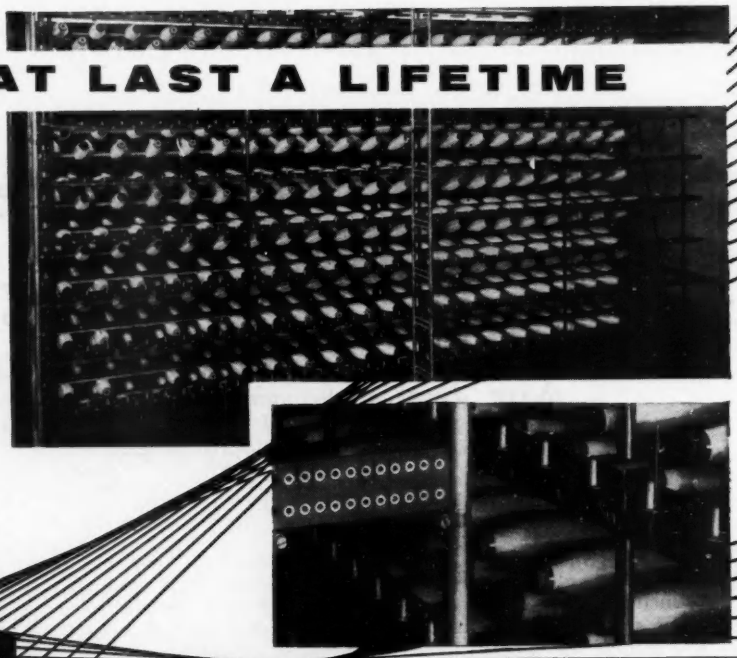

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purposes benzyl alcohol was found to be ideal. Of the many wool dyes found to be satisfactory for use by this method the neutral dyeing premetallised dyes of the Irgalan type deserve special mention since all this range is equally suitable for use. Most acid milling dyes of the Polar type are also satisfactory and a complete range of shades may be dyed by this process.

*Alternative Dyeing Methods.*—The following appear to be alternative approaches:—

**(1) To dye at or near the boil for a very short time.**
**(2) To dye at relatively low temperatures for a moderate length of time.**

Method (1) inevitably leads to a continuous dyeing system since normal dyeing machinery will not allow level dyeing in times of the order of 2 mins. Method (2) was therefore taken as the main target.

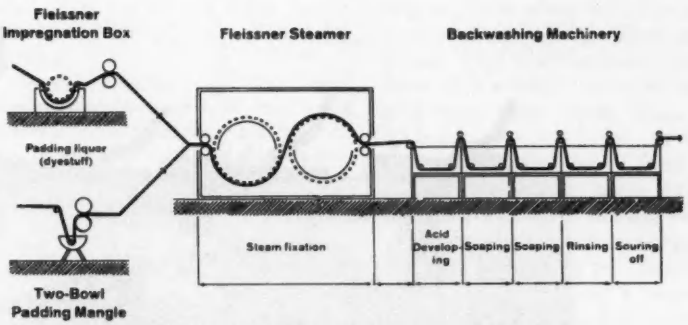
*Laboratory Tests.*—The principal factors involved in this form of dyeing were thought to be:—

**(1) Concentration of benzyl alcohol.**
**(2) pH.**
**(3) Temperature.**
**(4) Time.**
**(5) Dye and depth of shade.**
**(6) Liquor ratio.**
**(7) Glauber's salt content, or**
**(8) Electrolyte content.**

Each factor was examined independently while the others were kept constant.

It is no use having dyes which are not fully developed and we have checked our solvent-assisted dyeings against conventional dyeings, using the same recipe on similar material for shade and strength and also for wet fastness. The actual comparisons were made by boiling half of the solvent-assisted dyeing in a blank bath for 30 mins. and comparing the shade before and after boiling with that of the conventional dyeing, and then comparing all three dyeings for wet fastness.

From this work it becomes apparent that the primary control in this system of dyeing is the percentage of benzyl alchohol as measured on the total volume of the dye liquor, and that there is a minimum figure at which fully developed dyeings are given. If the concentration is allowed to fall below this figure, by adjusting the pH satisfactory exhaustion can be obtained, but the resultant dyeing does not have the true shade nor the same standard of fastness as the conventional dyeing. The first essential is therefore to set the concentration of benzyl alcohol at the required minimum for the temperature of dyeing used. The rate of strike must then be adapted to the requirements of the particular dyeing machine used by adjusting the pH, and this is in effect the secondary control.



Continuous dyeing of slubbing: pad steam/acid develop process

*Cost.*—A study of the cost of the solvent required for dyeing by this process soon showed that it varied inversely with temperature and directly with the liquor: goods ratio. The most favourable contents were thought to be 80°C. and a liquor ratio between 10 and 20 : 1. The cost of the solvent could best be reduced by re-using the dye liquor, and laboratory tests indicated that this is a possibility.

*Bulk Trials.*—So far more than 50 bulk trials on the dyeing of slubbing, loose wool and cashmere have been made. The results have been most encouraging, and in practice we have successfully re-used the dye liquors up to 17 times.

*Advantages*:

**(1) Quick dyeing method with a consequent saving in labour and overhead costs.**
**(2) Greatly increased production.**
**(3) Saving of steam and therefore lower fuel costs.**
**(4) Saving of water — particularly appropriate this summer.**
**(5) Slightly brighter shades because the wool is not yellowed as much as in normal dyeing.**
**(6) Applicable in many types of dyeing machines.**
**(7) Better condition of the material.**

*Disadvantages*:

**(1) Additional cost of the solvent.**
**(2) Necessity of having a suitable dyeing machine which will enable several dyeings to be carried out in the same dye liquor.**
**(3) The need for planning production to ensure the best re-use of dye liquors.**

Patents have been applied for and the process has provisionally been named the Irga-Solvent process for wool dyeing. It should not be assumed that only animal fibres can advantageously be dyed by this method, but it is still too soon to discuss in detail the dyeing of other fibres.

## Acid Dyeing Techniques

The third point concerns the evident trend in the trade of the introduction of a great number of special textile chemicals. Until several years ago most of the assistants that were used with normal wool or anionic dyes were themselves anionic in character. Typical examples of such products being Irgasol DA as a dyeing assistant and Irgalavone for stripping and levelling; Turkey Red Oil and pyridine were used mainly as solubilising agents.

The assistants used with the wool dyes obtain their effect from competing with the dye itself for the fibre sites and, for example, one could say that Irgasol DA included in the same recipe may sometimes be similar to Glauber's salt, but it does not have disadvantage of decreasing the swelling of the wool and has the advantage of being a strong dispersing agent. Many of the newer types of textile chemicals come into the non-ionic or cationic class, and many are on the border line between these two classes, i.e. a non-ionic but with a cationic tail on them.

The true non-ionics are in the main very good anti-precipitants but rarely show to advantage as rest aining agents in the dyeing of wool dyes, and they are often used as solubilising agents. The cationic, non-ionic types on the other hand show very strong restraining effect on anionic dyes in many cases, but it should not be thought that they may therefore be used as "cure-alls." Their mode of action is quite different from the Glauber's salt or Irgasol DA type which competes with the dye for the fibre sites. These cationics form a complex with the dyestuff, and this complex has much less affinity for the fibre than has the dyestuff anion. Unless this complex slowly and progressively breaks down at or near the boil, we get part of the complex on the fibre and not the original dyestuff. If this occurs one can expect to have poor fastness to

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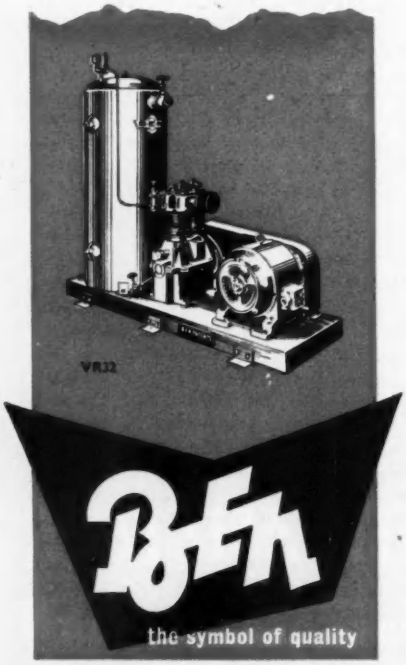


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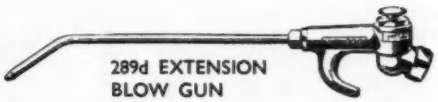

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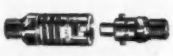

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CP 317

rubbing and wet fastness in general, with perhaps some alteration in shade.

The ideal dyeing assistant would, therefore, be one which would complex sufficiently at low temperatures and break down at or near the boil, at the right speed to allow the true dye to exhaust on to the fibre. This would not be too difficult with one dye, but seeing that there are several hundreds of dyes of varying anionic character it would appear reasonable to expect that many different dyeing assistants would be required, to cope the various types. The position becomes worse when it is realised that the complexing power of these cationics varies with the pH and to a minor extent the liquor ratio.

Great care is therefore necessary in recommending the use of these dyeing assistants, although if sufficient care is taken with preliminary trials in the laboratory, results can be most rewarding.

Several months ago we were requested to dye a series of very bright shades of carbonised piece goods which had not to be neutralised before dyeing, and SDC No. 2 wash fastness was required. The shades were too bright for the Eriolan range and acid dyes would not give the necessary wet fastness. This problem was solved by using Polar dyes with suitable dyeing assistants, even though there was 4% of sulphuric acid present in the fibre.

For some purposes it would be advantageous to dye yarn under acid conditions with Polar type dyes, and this can be done providing adequate care is taken in the preparation of each recipe and the dyeing conditions laid down are strictly adhered to. Extra care is to be taken with the neutral dyeing premetallised dyes of the Irgalan type since cationics complex them very strongly and poor fastness properties may result from these dyeings.

Pile fabrics have to be dyed under acid conditions, in order to allow the pile to stand well and this has been another outlet for this technique, but in recent years many pile fabrics have been prepared from a wool and "Fibro" or mohair/fibre pile as opposed to the original all wool or mohair piles. For this reason we have worked out a technique of dyeing union dyes, i.e. a mixture of selected cotton/wool dyes under acid conditions. This technique has proved satisfactory and its use has been extended to carpet yarns and the dyeing of union hand-knitted yarns.

## Locating Faults in Motor Starters

(*continued from page 550*)

control circuit. If large lamps are used it will be found that the coil operates, or attempts to do so when the lamps are placed across open-circuited contacts, providing the control circuit is otherwise intact.

### Other Control Circuits Faults

It may happen that a motor accelerates from rest when the control circuit is energised, but fails to reach full speed. This might be due to overload, low voltage or a burnt contact. In the case of a two-stage starter it might also be due to the second-stage contactor not operating. Again this may be due to a faulty coil, or to a faulty contact in the control circuit. Interlock contacts should be checked on the starting contactor, or on a timing relay (as at P in Fig. 4). The latter starter would not operate the changeover contactor from star to delta if there was an open circuit in the secondary winding $Q_1$ of the start-in contactor No. 1. This winding is used to energise the bi-metal timing relay which controls No. 2 contactor. Tests of the control circuit can be made as in the case of failure of the starting contactor.

The starter indicated in Fig. 2 employs a braking contactor to plug the motor into reverse when switched off. The braking action may fail if there is an open circuit at the interlock contacts R, or the braking switch S on the motor. If a push-button controlled starter switches itself off after the start push button is released there is a faulty contact at the "hold-on" contacts shown at T in Figs. 2, 3 and 4. The star-delta starter shown in Fig. 4 will switch back to start operation a short time after starting if there is a faulty contact at the contact U on the changeover contactor. The cause of faulty operation of any starter can be found by considering which contacts affect the operation.

## Crease-Resisting Theory : Treated Textiles

(*continued from 561*)

to give a "hard cure." This is difficult to accept on the basis of catalysis through hydrogen ions, but as the metallic ions are retained in the treated material, there is every probability that crease-recovery is enhanced by the co-ordination complex with some of the hydroxyl groups of cellulose and of the hydroxymethyl groups of the applied reagent.

Many resins which form three-dimensional structures inside the fibre give crease-resistance under conditions which make it difficult to accept the formation of co-valent bonds with the cellulose; for example, there are certain conditions of reaction which favour resin formation and give superior recovery from creasing, and there are other conditions of treatment which almost preclude the formation of a chemical compound with cellulose but give good crease-resistance. In all cases, however, there appears to be some entanglement through polar groups for if these are absent in the resin, or blocked in the cellulose, there is little or no recovery from creasing.

The strongest evidence for the co-valent cross-linkage producing crease-recovery comes from the bifunctional reagents, many of which are modifications of the fundamental work of Foulds, Marsh and Wood ; not all bifunctional reagents are equally satisfactory and there are many which do not give commercial results. There can be little doubt that the treatment of cellulose with polyfunctional reagents, whether resin-formers or reactants, is accompanied by a high degree of hydrogen bonding. With processes in current use, therefore, there is considerable evidence for some form of molecular entanglement which embraces hydrogen-bonding, complex formation, polymer formation and the production of co-valent cross-linkages, but it should not be assumed that the last-mentioned is the one and only explanation of the crease-resisting phenomenon.

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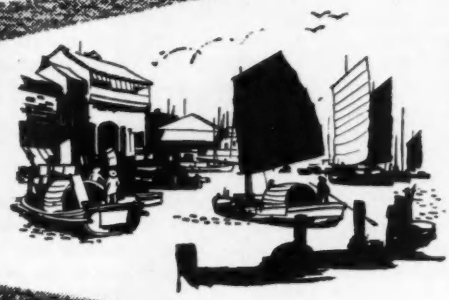

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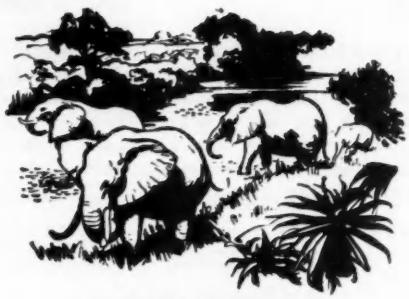

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# *Trade Literature*

MOULDING MATERIALS.—A new data book describing their range of thermosetting and thermoplastic moulding materials has been published by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1. The book provides information in tabular form and is divided into five sections, each dealing with a separate group as follows: (*a*) "Rockite" phenolic moulding materials, (*b*) "Styron" polystyrene moulding materials, (*c*) "Rigidex" rigid polyethylene, (*d*) "Rockite" polyester dough moulding compounds, and (*e*) "Tyril" styrene acrylonitrile copolymer.

* * *

USES OF NICKEL.—Inco-Mond magazine No. 11 issued by Mond Nickel Co. Ltd., Thames House, Millbank, London, S.W.1, includes articles on the uses of nickel steels in high-speed diesel engine and in oil-well pumps operating to a depth of 8,000 ft. The varied uses of nickel-containing stainless steels include articles on hospital equipment and pumps for chemical fluids. Other articles include the use of Cronite pots and boxes to cut the costs of heat-treating operations, also temperature measurement by platinum-rhodium thermocouples.

* * *

THE EPOK STORY. Produced as an illustrated guide to the nature and uses of Epok surface coating resins, a new booklet produced by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1, discusses the uses of paint in fifteen important fields. A special section is devoted to the particular requirements of the textile manufacturer. Synthetic resins are now extensively employed to improve fabrics by giving additional resistance to heavy and constant wear and increase their useful life.

* * *

NEW FILMS FROM MOBIL. "Lubricants with Care" and "Compressor Lubrication" are two new films available from Industrial Division offices of Mobil Oil Co. Other films completed include "Cutting Fluids," "Diesel Engine Lubrication," "Hydraulic Systems," "Lubricating Greases" and "Thin Film Lubrication." "Lubricants with Care" deals with the manufacture, transportation, storage, application and reclamation of high grade lubricants. It shows how storage should be carried out, why stores accounting should be emphasised and how correctly designed containers can avoid many common errors during the application of lubricants to all types of machinery. The other film deals with the operating principles and lubrication of all types of compressors.

* * *

NICKEL USES. Henry Wiggin and Co. Ltd., Thames House, Millbank, London, S.W.1. The latest issue of "Wiggin Nickel Alloys" (No. 51), features the use of nickel in tank manufacture for transporting phenol. The article shows how "AT" Nickel protects the purity, and therefore the colour, of phenol. Also featured is the use of steel plates clad with nickel or Monel in the construction of heavy items of chemical plant. Other articles include the uses of nickel-containing materials in high-speed steam cleaning units.

ELECTRICITY IN INDUSTRY. Issue No. 16 of "Electricity in Industry"—the technical review of the Lancashire Dynamo Group—contains an illustrated article on variable speed drives reviewing the development of equipment incorporating electronic and magnetic amplifier controls. A further article describes winding methods and coil construction of power transformers, and news of recent developments within the Group is also featured. Copies of this issue may be obtained from Lancashire Dynamo Group Publicity Services, St. Stephen's House, Victoria Embankment, London, S.W.1.

* * *

T.A.I.R.O. AND INDIAN TEXTILE PROGRESS. Published by the Textile and Allied Industries Research Organisation in collaboration with the M.S. University of Baroda, Baroda, India, Price 7s. 6d.

The essential object of this 119-page publication is to collect and concentrate into one volume, the achievements of educationalists, administrators, industrialists, and technologists associated with T.A.I.R.O. over the last four years. Twenty-one articles are included, covering a particularly wide field of research. The first of two items meriting special mention is a new picker tester, developed at T.A.I.R.O. and reviewed by Mr. B. B. Joshi. In the second, Prof. K. H. Patel discusses the new heald tester, a machine designed to determine the wear resistance in healds.

* * *

LAMP PRICE LIST. A.E.I. Lamp and Lighting Company Ltd., 44 Fitzroy Road, London, N.W.1, has issued a new pocket price list of their Mazda lamps. The list tables in condensed form all lamps readily available with the exception of photograph and projector lamps. Included in the booklet is a centre section of display material.

* * *

CATALOGUE OF GENERAL CHEMICALS. A new publication from Albright and Wilson (Mfg.), 1 Knightsbridge Green, London, S.W.1, lists close on 400 regular products that are handled every day by the General Chemicals Department of the company. These general and fine chemicals are detailed in alphabetical order; a brief description of physical form and the nature of the packs the products are available in is useful additional information.

* * *

LOOM SPINDLE BUFFERS. A new leaflet (No. 314) from George Angus and Co. Ltd., Angus House, 152-158 Westgate Road, Newcastle-upon-Tyne 1, gives details of a range of these important weaving accessories made from Gaco synthetic material. Available in four lengths, three outside diameters and a range of spindle sizes, the buffers are tough, oil-resistant and firm.

* * *

MERSTEEL DIAL THERMOMETERS. Details and specifications for the mercury-in-steel, rigid stem thermometers are set out in an illustrated leaflet released by Negretti and Zambra Ltd., 122 Regent Street, London, W.1. They are a robust and accurate method of temperature control.

TECHNICAL INFORMATION. I.C.I. Ltd., Dyehouse Department, Dyestuffs Division, Recent releases include the following circulars—No. 495: Fastness to Hypochlorite Bleaching. No. 496: Weathering Fastness—Azoic Dyestuffs. No. 497: Application of Vat and Azoic Dyes to Wool/Cellulosic Fibre Blends. No. 498: Procion Brilliant Blue H7G: Dyeing of Cellulosic Fibres by Batchwise and Pad-Roll Procedures. No. 499: Wash and Wear Finishes Based on Calaroc EU. No. 502: Dyeing Wool/Cellulosic Fibre Unions under Acid Dyebath Conditions.

* * *

TECHNICAL PUBLICATIONS — SUBJECT INDEX. I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester.

The fifth edition of this valuable publication covers the period January, 1945 to December, 1958. In this guide to the more recent technical literature, the general pattern of earlier editions have been followed but modifications have been introduced to increase the usefulness of the index. The serial number of each sales circular, auxiliary products pamphlet, Dyestuffs Division chemicals pamphlet, and of each item in the technical information series has been given to facilitate reference. These numbers are a valuable aid to the Division literature stores personnel in meeting requirements and, if quoted, will facilitate service.

* * *

TESTS FOR ENGINEERING APPRENTICES. Selection tests which go a long way to guarantee the quality of boys engaged as engineering apprentices have been devised by the National Institute of Industrial Psychology, 14 Welbeck Street, London, W.1. The report recalls that these tests were introduced experimentally by a number of firms towards the end of the war to suppement ordinary selection methods, and were later adopted by others. In an examination of the records of nearly 2,000 apprentices employed by 19 of the companies, detailed statistical comparisons have now been made between their scores in the tests and their subsequent achievements at technical college and on the shop floor. These comparisons and their ultimate conclusions are fully described and set out statistically in this valuable publication.

* * *

TECHNICAL INFORMATION. The following publications are now available from I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester.

No. 522—Indigo on Cotton.

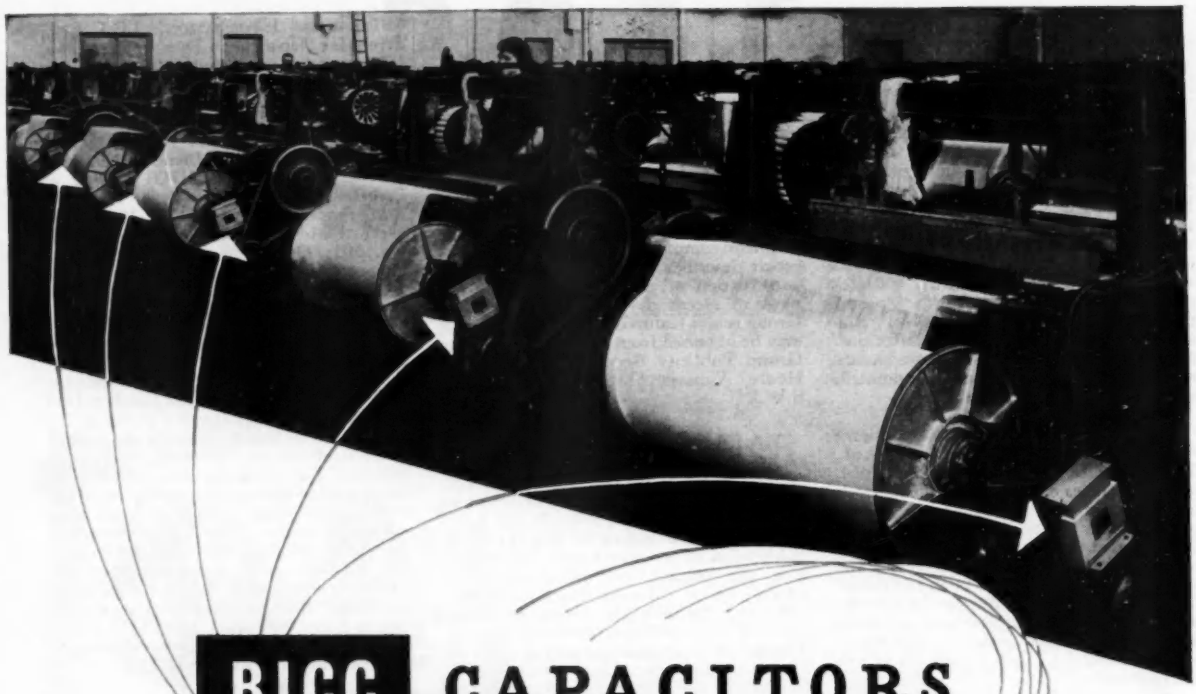
No. 526—Hazards Associated with the Application of Shirlan to Textiles: (*a*) Discolouration of Textiles by Shirlan, (*b*) Loss of Effect on Sulphur Black-Dyed Textiles.

No. 500 (replaces No. 450). Subject Index to Technical Information Leaflets (Dyehouse) Nos. 161 - 499.

No. 524. Procion/Soledon Combinations in Dyeing: Production of Yellow/Green Shades on Cotton and Viscose Rayon Fabrics.

* * *

PLASTICS IN PACKAGING. In the second issue of this publication, issued by Bakelite Ltd., 12 Grosvenor Gardens, London, S.W.1, the subjects covered are squeeze packs, laminated films, blow-moulded novelty packs, high-clarity packs for garments, toys and games, and polyethylene for packaging foodstuffs.



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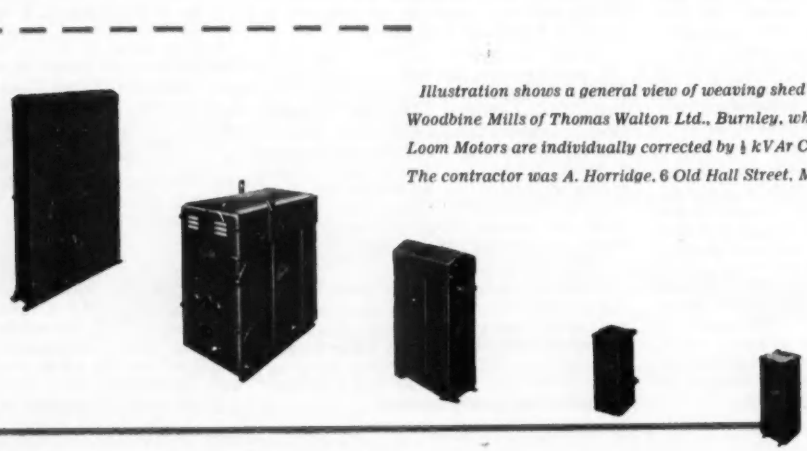

*Illustration shows a general view of weaving shed in the Woodbine Mills of Thomas Walton Ltd., Burnley, where 192—¾ H.P. Loom Motors are individually corrected by ½ kVAr Capacitors. The contractor was A. Horridge, 6 Old Hall Street, Middleton.*

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# Textile Trade and Prospects

## *Linen Trade Review*

The reported increase in flax growing in the U.S.S.R. in 1959 makes it difficult to find a reason for the decline in exports during recent months, and still more difficult to credit the report—still unconfirmed—that no flax fibre will be available for export in 1960. While no clear picture of the present position of the flax growing industry in Iron Curtain countries is available for West European linen manufacturers who have, in recent years, become increasingly dependent on this source for their raw material requirements, the impression conveyed from such data as has been available was of an increasing exportable surplus, with emphasis on improvement in the quality standard to make it more competitive with West European supplies.

British linen manufacturers generally, and the Scotch dry spun section in particular, would be hard hit by the loss of this valuable raw material market which, in recent years, has offset the loss sutained by the cessation of home flax production. The substantial decline in production in West European flax growing areas during 1959 will aggravate the supply position, and would inevitably force raw material values above their economic level.

The sudden development of this problem following on the considerable expenditure of money and effort on plans to stimulate consumer interest in British linens at home and abroad seems likely to undo much that has been achieved in this direction. With demand for yarns running at a high level, and most mills booked up into the spring of 1960, spinners are now showing considerable reluctance to accept further commitments at definite rates in view of the uncertainty of obtaining the necessary raw material cover. Many are already booked substantially in advance of fibre stocks in hand, anticipating a normal supply from crop reports.

The present position emphasises once again the need for a domestic source of flax supply sufficient in bulk to meet approximately 25 to 35% of the industry's raw material requirements. This would prevent price exploitation by overseas suppliers while also ensuring a nucleus industry capable of rapid expansion in time of national emergency, as has happened twice in the last half century. On each previous occasion a substantial nucleus was available for development. None such exists now on which to build.

The alternative lies in a wider use of man-made fibre staples, which can be processed advantageously on flax tow spinning equipment, and of which ample domestic supplies are, or will shortly be available. While a substantial percentage of equipment has been diverted to this purpose there is still considerable scope for expansion, particularly by extending the count range and developing novelty yarns.

Despite the serious raw material problem the present high level of demand for linen manufactures constitutes a welcome corrective to the disappointing trading reports now being published for the year ending June 1959. That for the York St. Flax Spinning Co. Ltd., Belfast, showing a loss for the year of £109,926 after crediting £25,000 transferred from reserve. At the annual meeting the chairman, Sir H. Mulholland, attributed the heavy loss to uneconomic cloth prices. He stated that, while the cost of raw material had risen by 15 to 20%, with yarn prices following, cloth prices remained virtually unchanged. He concluded that these must be advanced by, at least, 10%. While all manufacturers would welcome wider margins current selling prices are to a large extent—and particularly in the highly competitive textile market—determined from the consumer end, and the successful manufacturer is he who can equate a profitable selling price with the consumers' assessment of value.

In view of the emphasis frequently placed on linen as a craft industry it is open to question whether the trend in re-equipment in recent years has been favourable to the employment of its skilled operatives and technical "know how" to produce and develop the speciality lines which constitute the normal output of a craft industry. The closure of post-war modernised plants, and the uneconomic operation of some still in production, suggest that those responsible for planning the change over have fallen between two stools, mainly as a result of their failure to grasp the trend of competition in world textile markets, and its possible bearing on consumer interest. Some of the money at present being spent by the British linen trade on publicity—which helps also to sell the products of competitive centre of manufacture—could be employed more profitable on market research.

In view of the long term uncertain outlook for the industry, and the progressive decline in demand for its products, the question arises whether current expenditure on scientific research is justified by the results, and if the present programme is in the best interests of the industry, which call for emphasis on technological investigation to develop novel yarn and fabric structures with consumer appeal.

The onus for this does not rest solely with the industry's research organisation. It calls also for co-operative effort by individual firms. This was emphasised by Sir Gordon Russell, director of the Council of Industrial Design, during his recent visit to N. Ireland. He suggested that an industry like linen should forget internal differences and put on an exhibition which would benefit the industry as a whole. That could be done only by first having a higher standard of design. He did not suggest that some of the designs on coloured linens were not good. There ought to be a lot more of them, and there should be research on design.

## *Wool Consumption and Prospects*

British mills' consumption for the year may be near the post-war record of 528 million lbs. (clean weight) set up in 1950. Production of wool tops (combed wool) in the U.K. is also heading for a post-war record. Most recent figures issued by the Wool Industry Bureau of Statistics, show that although the rate of wool consumption was slightly lower than in October, in September it was 17% higher than a year earlier. Consumption for the topmaking trade was 22% higher and for woollen spinning 9% higher than in October last year. Top production and worsted yarn delivery rates for October, although a little lower than in September, were 22 and 14% respectively higher than the year before. Wool cloth delivery rate, fractionally below that of September, was more than 7% higher than in October, 1958. Output figures for October were: wool consumption, 47·26 million lbs. (clean); top production, 31·95 million lbs.; tops drawn, 20·37 million lbs.; worsted yarns delivered, 22·43 million lbs.; woven wool cloth delivered, 34·64 million sq. yds.; blankets delivered, 3·33 million sq. yds.

Dalgety's, the Australian pastoral firm, forecast that Japan's purchases of Australian wool may reach a new record level this season.

In Sydney, a spokesman for the firm said that Japan had bought heavily since the season began and had taken about 20% of the clip offerings so far. British buyers had bided their time during recent big short-notice buying by Soviet representatives, but Britain had now reasserted its traditional influence on the market. France, Germany and Italy were leading a booming continental demand for wool, while Poland and Czechoslovakia were the biggest and most consistent importers of Australian wool in the East European communist bloc. China bought three times as much wool from Australia in the three months ended September as she did in the same quarter of 1958, according to the Commonwealth statistician, Mr. S. R. Carver, in Canberra.

In the September quarter of this year, China bought 6,416,000 lbs. of wool, worth £2,155,200 (sterling). In the same quarter last year China's purchases amounted to 1,962,000 lbs., worth £728,000.

Australian wool sales for the July - October period totalled £82,124,436 (sterling) compared with £56,231,944 for the same period in 1958. Proceeds came from 1,370,923 bales (1,198,615 for July - October last year).

Sales of 1,353,757 bales of greasy wool returned £81,071,460, while sales of 17,177 bales of scoured wool brought in £1,052,976, report the National Council of Wool Selling Brokers of Australia. The recent London wool sales closed with prices generally firm and, in some cases, against the buyer compared with the opening a fortnight earlier. Some spec-

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ulators' wools of shabby and inferior character attracted little interest and prices were irregular owing to their unsuitability for the topmaking trade, but merino clip wools and stockpile offerings closed firm.

Several types of crossbred combing wool closed against the buyer, and revealed evidence of a keen spot demand from topmakers who are still awaiting arrival of the first new season shipments from New Zealand. Slipes were firm to 2½% dearer, compared with opening rates.

## *Jute Fibre, Yarn and Fabrics*

Towards the end of November the raw jute market in Pakistan became firmer and it was necessary for the authorities there to raise the E.P.C. values of some grades of fibre. This dearer trend continued into December with nothing to indicate that the peak has been reached. Spinners in Dundee bought heavily during the first five months of the season when prices were at a reasonable level and it is possible that demand for fibre from the U.K. will now fall away. During the previous season U.K. spinners secured approximately 10% more raw material than their actual consumption and with further large purchases this season they can now remain out of the market for some time. Continental spinners, not so fortunate, have been purchasing only near requirements and they will have to continue securing their needs despite a much firmer raw material market.

Indian mills are reported to have purchased 72,000 bales of cuttings from Pakistan and negotiations are now taking place for a further 280,000 bales being exported to India. This has made the cuttings market much firmer and some high prices have been paid. This buying of Pakistani jute by India is due to the out-turn of the latter's crop being of smaller size than expected. This unexpected demand could make for a dearer raw material position in the coming months. Prices at present are very irregular with Mill Firsts at £112 to £118, Mill Lightnings £96 to £101, Mill Hearts £83 10s. to £87 and grade Hearts £67 to £71, c.i.f. U.K., for Dec./Jan. shipment. Dark jute is also irregular with grade Tossa-2/3 at £109 to £112, grade Tossa-4 at £95 10s. to £98 and Continental Tossa-2/3 at £88 to £90. Crack Daisee-2/3 is at £94 and grade Daisee-2/3 at £88, Dec. - Jan.

With Dundee spinners holding large stocks of raw material, they are now only interested in the forward shipment position. However, most shippers are asking a premium for buying ahead and spinners are refusing to follow these higher rates. A fair amount of material is still available on spot Dundee and some transactions have taken place. In many cases the prices paid have been well below shipment rates. Already this season the registered sales of raw jute to the U.K. are approximately 500,000 bales which is about two-thirds of their annual consumption.

Shipments of jute from Pakistan this season have again been very promptly made but with the dearer market and small imports of loose jute from up-country there is the possibility of some delay in the future.

Demand for yarns in Dundee has improved greatly during the past month. Due to the dearer raw material position it was necessary for prices of many descriptions to be raised but prior to this, consumers placed large orders for delivery well forward. Since then business has continued on a small scale but spinners generally are now fully booked for delivery over the first quarter of next year. The carpet trade has secured considerable quantities of yarns and contracts are being renewed.

The manufacturing end of the trade is also very busy and most descriptions of cloth have been sold for delivery up to three months ahead. The wide cloths for carpet backing have experienced a large demand and the full production is now taken up for delivery well forward.

The manufacturers of heavy goods, such as sackings and tarpaulins, have also found a great improvement in demand and many substantial orders have been placed. Certain descriptions of sackings are now only available two to three months ahead, and this is a great improvement in the position compared with a month ago.

## *Cotton Yarn and Cloths*

Trade in yarn and cloth in the few weeks prior to Christmas was better than for many months. The extent and progress of the scrapping programme has accelerated buying activities to a remarkable degree. The fear of long-term buying is always quickly dispelled when any prospect of near or long-term shortages threaten to arise. Many manufacturers are feverishly trying to ensure adequate supplies from new sources and this, together with added commitments from old customers, has lengthened spinners' order books to an undesirable extent. Many people still hold the view that the compensation for scrapping has been far too attractive, and managements and directors with large shareholdings have welcomed this easy and very remunerative way out instead of making a fight to stay in business. The extent of the breaking-up process also offers opportunities for those devoid of conscience to engage in new "rackets," difficult to trace, but undoubtedly profitable where spares and accessories are concerned.

Business in yarns has been widely spread, covering practically every count and quality in single and folded types. The bulk of the business has been in standard weaving qualities on cop, ring beams, cones and hanks. Inquiry for medium and fine combed mule doubling wefts has been much better than for a long time and hosiery numbers are in keen request. No small amount of anxiety is already clearly apparent at the rapidly deteriorating position regarding reasonable delivery dates. Coarse counts and condenser yarns are readily bought. Slight increases in the prices of some staples have caused concern to some spinners but margins on the whole are satisfactory. Interest steadily increases in the expanding range of fancy effect yarns and the possibilities offered by the blended types in single and folded counts.

Similar supply problems exist in cloth, with buyers having fears that orders booked now have longer delivery dates attached. Brisk orders have followed short negotiations and many attractive offers in dress goods have been eagerly snapped up. The latest types and designs in screen and roller printed cloths have sold well and new constructions in dobby and jacquard apparel fabrics almost sell on sight. Large quantities have been booked and there is no easing-off in the spate of orders. Furnishing fabric manufacturers are being pressed for quick delivery and to accept additional commitments from merchants, etc., already threatened with diminishing supply sources. Medium-priced cloths in traditional and contemporary designs find no lack of buyers and all output, whether in all-cotton or cotton/rayon constructions, is speedily sold. Household textiles are in very keen request following depletion of stocks by the Christmas trade. Sheets, quilts, tablecloths, etc., have sold quickly and terry cloths are experiencing a mild boom. Two-fold and condenser pile cloths are in good demand. Colour in both dobby and jacquard styles is extremely important in these specialities. In all business negotiated, most has been on home trade account. Industrial cloths have been accorded more support and, in overseas outlets, a few improved orders have been fixed for one or two Continental markets and the Near East.

## *Silk and Man-Made Fibres*

Business continues reasonably good compared with twelve months ago and those who have decided to stay in business in Lancashire feel more confident about the future. Most types of yarn are in good request but with the steadily lengthening order books deliveries may not be easy. It is no longer a question of immediate delivery. The demand now accumulating is likely to create difficulties and March has been forecast as a time when there may well be a temporary shortage of cloth. This feeling has not passed unnoticed, and there has been even greater rush on the mills to fasten business. Furnishing fabrics appear to be under particularly heavy pressure just now, blends of rayon and cotton, all rayon, and blends of the newer fibres and rayon. In dress fabrics, interest continues in acetate poults and another noteworthy feature is that a number of manufacturing concerns are now producing more acetate fabrics than for many years. A steady call exists for blends of "Terylene" and cotton for men's shirtings, and "Acrilan" blends are in demand for a variety of purposes, including household textiles.

In Yorkshire, order books are in good shape but there is a shortage of labour on the spinning side. Most blended yarns are in brisk demand, and spun nylon and "Terylene" sell well to the Midlands' trade. The trend for fabrics on the woollen system continues, and some excellent furnishing fabrics of high-strength rayon are being produced. In the suiting trade, blends of "Terylene"/wool continue to be popular and the demand for "Acrilan" and wool blends remains steady.

Macclesfield and Leek areas are busy with some throwsters unable to fulfil the spate of orders, except, of course, on fairly long delivery dates. Silk is very prominent and printers are active in meeting a large demand for the latest screen printed styles. Roller printers are moderately well employed and plenty of nylon and rayon styles are passing through in tie fabrics, necksquares; in certain high-class designs hand-block printing more than holds its own.

Manufacturers are fully occupied with textured nylon yarns in demand for shirtings. Non-torque nylon yarns for outerwear are in good request.

The commission dyeing sections have not found things easy because of the reorganisation now taking place in Lancashire and Yorkshire.

1835 1845 1855 1865 1875 1885 1895

# WEAVING

1905 1915 1925

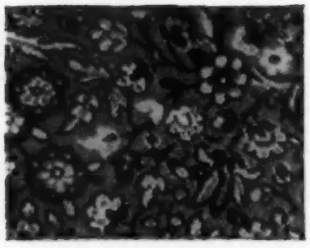
*through the years...*

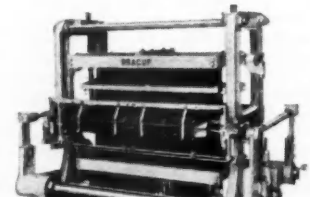
1935 1945 1955

**1959**

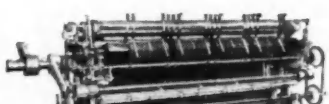
In the year 1825 Samuel Dracup founded a Jacquard Machine business destined to become world-wide in importance. The textile industry of the world now acknowledges that Jacquard machines by DRACUP are the finest obtainable. They step up production, reduce operational overheads and have a range of pitches and capacities to meet all purposes.

We invite you to weave better, faster and cheaper with Dracup Jacquards.



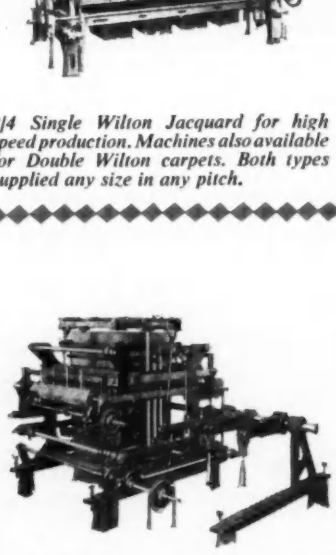


*Heavy duty matting Jacquard for SISAL and COIR matting. Available in all sizes up to 24/4.*



*8/4 Single Wilton Jacquard for high speed production. Machines also available for Double Wilton carpets. Both types supplied any size in any pitch.*

*New type coarse pitch double lift single cylinder Jacquard. Available in all standard sizes. Double cylinder machines of similar design also available.*



*3-position Moquette Jacquard for all normal moquette weaves and special float effects.*

**EVERY DRACUP JACQUARD IS BACKED BY OVER 130 YEARS EXPERIENCE**

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# Notes and News

### Procion Brilliant Purple H3R

A homogeneous reddish purple of good washing fastness and excellent light fastness, Procion Brilliant Purple H3R is of principal interest to textile printers, particularly printers of cotton and viscose rayon, and has the virtue of building up well to deep shades under printing conditions. The new dye belongs to the "H" class of Procions and requires steaming (minimum 5 mins.) for fixation, but its lower reactivity gives it the compensating advantage of very good print paste stability. Procion Brilliant Purple H3R is not recommended for printing chlorinated wool and is not dischargeable.

* * *

### More Wool in Tufted Carpets

There has been a 300% increase recently in the use of wool in the production of tufted carpets, states Mr. P. M. Jones, president of the Metropolitan Floor Covering Association, U.S.A. Mr. Jones, in the course of an address, said: "It is interesting to note that this year shipments of woven carpets increased about the same rate as tufted carpets. This is contrary to the experience of the industry over the past few years. Another outstanding feature of this year's situation is the relative increase in the use of wool. In 1958, for the first time fibres other than wool were used more than wool itself. The wool used amounted to only 48% of the total fibre consumption.

"During the first seven months of this year wool accounted for 57% of the total with other fibres accounting for 43%. Wool consumption in tufted carpets has accounted for most of this increase. The use of wool in this construction is up 300%. In woven carpet production 75% of the yardage is all wool, 18% is blends of wool and synthetics. There is, practically speaking, no change in this situation from a year ago."

### Scottish Tweed in Danish Display

Ten examples of Scotland's superb woollen cloths are featured at the British Design Exhibition at the Copenhagen Museum of Decorative Art. The cloths, all from manufacturers' normal ranges, were selected by Prof. Erik Herlow, designer of the exhibition. It has been sponsored by the British Import Union of Denmark, the Danish - British Society and the Council of Industrial Design. The cloths displayed include colourful tweeds, soft-handling sports cloths, tartan cloth, fine merino worsteds and Cheviot coating. Exhibitors are Gibson and Lumgair Ltd., Selkirk; Peter Macarthur and Co. Ltd., Glasgow; Reid and Taylor Ltd., Langholm; Robert Noble and Co. Ltd., Hawick; the Strathmore Woollen Co. Ltd., Forfar; and Lowe, Donald and Co. Ltd., Peebles.

* * *

### Smiths New Central Showroom

The Smiths Centre, recently opened by H.R.H. Prince Philip, Duke of Edinburgh, is situated on the ground floor of the headquarters building of S. Smith and Sons (England) Ltd., Cricklewood. It has been created to form part of a large scale information programme which the company has recently instituted. The centre occupies an area of 4,000 sq. ft. and shows a selected range of products from every side of the business, grouped in specific industries or applications. It also provides a historical panorama of the growth of the organisation, together with a broad detail of the "things Smiths make," in their factories at Brighton, Barkingside and Basingstoke; at Cricklewood, Colindale, Watford, Putney, Slough, Cheltenham, and Witney; at Wishaw, Carfin and Hillington in Scotland; at Treforest and Ystradgynlais in Wales—twenty in all. A fully-equipped projection box shans the central section of the centre and seating accommodation is available for sales conferences, demonstrations, press receptions, and other functions. The centre houses a permanent exhibition always changing and always up to date.

* * *

### New Labelling Scheme

Courtaulds Ltd. are introducing a new labelling scheme to restrict the registered trade mark "Courtelle" to fabrics, garments and other goods of satisfactory quality. The conditions of sale include a new clause preventing use of the name "Courtelle" when the fibre is "processed, treated or used" in any way not approved by Courtaulds Ltd. They believe it is in the interests of all concerned to safeguard the reputation of "Courtelle," their acrylic fibre. This scheme will encourage the manufacture of good quality fabrics, garments and other goods containing "Courtelle."

Under the new scheme, manufacturers of fabrics containing "Courtelle" will be asked to submit samples and details of the proposed end-uses. The samples will be tested at Coventry and if considered satisfactory, Courtaulds will authorise use of the trademark "Courtelle," and supply labels and other promotional aids for use on garments made from the fabric. Makers-up wishing to use the labels and sales aids will be asked to supply details of the fabric type of garment to be made and, where pleating is involved, the pleating process used; sample knitted garments will also be tested. Should these samples fall below the standard required for the "Courtelle" labelling scheme, Courtaulds' technologists will assist manufacturers or makers-up to rectify defects.

* * *

### "Terylene" in the Mines

Ventilation ducting has an all-important role to play in coal mines. Recently an order was placed for more than 30 miles of p.v.c.-coated "Terylene" ventilation ducting (fire-resistant in accordance with N.C.B. requirements). This varies in diameter from 12 to 24 ins., and has been stitched throughout with "Terylene" thread. Made up by Robert Watson and Co. Ltd., Newburgh, Fife, from a specially woven 2½ oz./sq. yd. twistless "Terylene" base fabric produced by C. A. Newsholme and Co. Ltd., Keighley, Yorkshire, the ducting is about three times lighter than that formerly used. Its use results in easier handling, while very high rot resistance and retention of tear strength are marked advantages where damp conditions prevail.

* * *

### Glycerine Helps Lubricate Knitting Machines

Sterling Hosiery Mills, Spindale, N.C., U.S.A., have developed a rapid method of cleaning full-fashioned knitting machines using a combination of pressurised steam and a solution made from cleaning powder, hot water and glycerine, applied by a double-hose steam gun. The glycerine leaves the machine with a slightly moist, smooth finish which is said to greatly decrease rejects due to snagging during the knitting process.

**The imposing entrance to the showrooms and conference hall at the Cricklewood Headquarters of S. Smith and Sons (England) Ltd. Opened recently by H.R.H. The Duke of Edinburgh**

ALL CARPET MANUFACTURERS

# MACKIE

## Invites you to see this Carpet Plant for yourself

It is not a practical proposition to exhibit this complete plant at the Milan Exhibition.

Therefore we cordially invite all carpet manufacturers to visit our works at Belfast where a plant is in operation. You will be able to study the production process and discuss your own problems with our technical staff. Should you be unable to make a personal visit we should be pleased to process a sample of your material for your inspection.

**SPECIAL FEATURES**

A Regular Yarn.

Approx. 2-2½ times stronger than a woollen spun yarn of the same material.

Already proven to be the cheapest method of converting stock to yarn.

Suitable for Viscose, Acetate, High Crimped Nylon and Woollen Blends from 4·5-50 Deniers and 4"—8" staple and wool.

TEXTILE MACHINISTS
SINCE 1846

*James Mackie & Sons Ltd*

BELFAST
NORTHERN IRELAND

CARPETS

S 6.

### Glycerine Helps to Stiffen Nylon

Polyamide textile materials such as (polyhexamethylene) adipamide and polymers from caprolactam may be stiffened by treatment with an aqueous solution containing the ammonium salt of an acrylic acid polymer, a polyhydric alcohol, and optionally an acid catalyst, followed by heating at 150°C. or above. Glycerol is a suitable polyhydric alcohol, and substances which become more acidic on heating, e.g. ammonium dihydrogen phosphate may be used as catalysts. (B.P. 811,735.)

* * *

### Easy-to-Make Lamp Cleaner

A cleaner for maintaining light output of industrial fluorescent lamps and reflectors in industrial plants (6) consists of glacial acetic acid (99%), 1 oz.; methyl alcohol, 2 ozs.; oxalic acid crystals, 1 oz.; lactic acid crystals, 1 oz.; butyl acetate, ½ oz.; amyl acetate, ½ oz. and glycerine, 8 ozs. These are mixed until the oxalic acid crystals dissolve, then the glycerine is followed by butyl alcohol until the solution becomes clear. The solution is applied at room temperature to reflectors and tubes with a soft brush then rinsed with a clean sponge.

* * *

### Dyeing Wool with Metal Complex Dyes

In a recent paper on "The Kinetics of Dyeing Wool with 1 : 2 Metal Complex Dyes" to the West Riding Section of the Society of Dyers and Colourists Dr. H. Ackermann (J. R. Geigy, S.A.) described a number of experiments in which he had investigated the influence of cations—hydrogen, sodium, calcium and magnesium—on the neutral dyeing of wool. Generally, he said, the cations increased the rate of dyeing by influencing the distribution equilibrium according to the law of mass action; but they could in certain cases also promote aggregation and so slow down the rate of exhaustion. The results of these investigations explained, for example, why dyeing was much faster in hard water than in soft under otherwise identical conditions, making it easier to get level results and reproducibility by using soft water.

* * *

### World Congress for Man-Made Fibres

The second World Congress for man-made fibres will take place in London in 1962 from May 15 - 18. Speakers of international repute will address the Congress on subjects of general interest, and technological and economic matters affecting textiles will be discussed at working meetings. Particular attention will be given to future developments in man-made fibres and their place in modern life. It will be recalled that the first International Congress organised by the International Rayon and Synthetic Fibres Committee took place in Paris in 1954.

* * *

### Customer Service Testing Laboratory

A new textile testing laboratory to assist customers in Europe and other parts of the world in the use of their synthetic fibres has been opened by Du Pont de Nemours International S.A., at 81 Route de l'Aire, Geneva, Switzerland. The laboratory will conduct tests on the physical properties of fibres and yarns; the strength and wearing characteristics of fabrics; and the ease with which new fabrics and garments can be cared for. Equipment is also provided to determine the fastness of colours to sunlight and washing and to match colours. Mr. M. J. Wyser, a Swiss chemist, will direct the operation of the laboratory which will be staffed entirely by Swiss specialists. Mr. Wyser has had wide experience in laboratory technology in Switzerland and Canada.

The new laboratory, located in the Etoile Building, will be able to draw on the scientific resources and vast experience of the parent company's textile research laboratory near Wilmington, Delaware. It will serve customers for the company's fibres in Europe, Africa, Middle East, Asia, the Pacific area, and Australia. It will also supplement the company's "Orlon" acrylic fibre plant in the Netherlands, scheduled to start production in 1961.

* * *

### Reinforcing Concrete Floors

A new product called Hexweb is proving successful for reinforcing concrete floors. Manufactured by Causeway Reinforcement Ltd., Five Ash Works, Dover Road East, Northfleet, Kent, it is a webbed chilled cast-iron floor grid designed and chemically toughened to meet the load demands of the heavier industrial floors. Each grid is hexagonal in shape, and has a mean diameter of 11½ ins. The grids are laid in a concrete wet mix and infilled with a stiff infiller. This combination provides, it is claimed, a flooring of exceptionally long life which will resist wear under all rolling and shock loads; additionally it offers resistance to corrosion and is anti-skid. Individual grids can be removed from the floor without disturbing adjacent grids. By their design they meet situations where trucking in all directions takes place since they present no continuous leading edge against which the wheels can strike and cause fracture. The three-point ground contact prevents voids when infilling; it can be laid without breaking up existing surfaces, and the graduated hexagon bars make possible a concrete underfloor with added sheer lines.

* * *

### U.K. Wool Top Stocks

The Wool Industry Bureau of Statistics reports that stocks of wool tops in the U.K. at October 31 were 73·4 mn. lbs. (comprising 51 mn. lbs. merino, and 22·4 mn. lbs. other sorts). When the 1959 census of top stocks was taken at August last, preliminary results did not confirm the estimates and the impression was that stocks might lie in the hands of firms who were not regular holders, and with whom the Bureau was not in contact. This second census was therefore taken at October 31, not on the usual basis of ownership but on the basis of tops on the premises of firms, including warehouse-keepers, whether owned by them or not. This confirmed, within a narrow margin, the estimates of the Bureau, which states that "an analysis of the figures suggests that the quantity of Wool Terminal Market tops in which interests outside the trade could be concerned, might amount to some 5 or 6 mn. lbs."

* * *

### New Wool Boom

U.K. exports of wool and woollen and worsted goods are rising and here are jobs available for a further 3,300 in the wool textile industry, according to Board of Trade figures given at a meeting in Leeds of the Regional Board for Industry. It was reported that many mills are enjoying their best run since 1953. Export levels were encouraging and recent statistics showed substantial increases in the volume of wool and wool products exports for the first 10 months of 1959 compared with Jan. - Oct. 1958. Mr. D. A. Wilson (regional controller, Board of Trade) stated after the meeting that good conditions were due to a buoyant home market and a good export market. There had been increases in exports of all types of textiles, particularly in tops. Unemployment in Bradford is now at the lowest level since before the 1958 textile recession.

* * *

### Australian Wool Futures

Mr. Clive Hall, chairman of the newly-formed Sydney Greasy Wool Futures Exchange, who visited London and Bradford for informal conversations with wool futures market operators, said the Sydney wool futures market will begin to function before the end of February, 1960 and that 10 of the 15 floor members have been appointed already. Unit of contract will be the greasy equivalent of 3,000 lbs. clean weight of shorn Australian wool, and the standard type will be Australian Wool Bureau type 78, but deliverable wools, ex-auction, will spread over a range of 85 types of Australian merino combing wool, representing about 1½ million bales out of the Australian clip. Delivery months in the Sydney futures market will be the same as in the London wool top terminal market, namely, January, March, May, July, September, October and December.

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## *New Companies*

**Anglo-Orient Manufacturing Co. Ltd.** Private. Reg. Nov. 6. Capital £10,000 in £1 shares. Manufacturers, converters, exporters, importers and dealers in yarns, plastics, metals, chemicals, etc. Registered office: 50 Whitworth Street, Manchester 1.

**T. and M. E. Gabriels Co. Ltd.** Private. Reg. Nov. 9. Capital £500 in £1 shares. Manufacturers and dealers in merchandise of all kinds, including surplus stores and equipment, textiles and fabrics, etc. Registered office: 36 Fishponds Road, S.W.17.

**T. H. Peers Ltd.** Private. Reg. Nov. 9. Capital £1,000 in £1 shares. Brokers, agents, exporters, importers, manufacturers and dealers in wool, worsted, alpaca, mohair, cotton, etc. Registered office: 49 Hustlergate, Bradford.

**Bemder Ltd.** Private. Reg. Nov. 11. Capital £5,000 in £1 shares. Manufacturers and dealers in wool, woollen mixtures, felts and worsted goods of all kinds, etc. Registered office: Midland Bank Chambers, Barnoldswick.

**George Cork Ltd.** Private. Reg. Nov. 12. Capital £1,000 in £1 shares. Manufacturers and dealers in weavers' requisites, etc. Registered office: Keighley Road, Colne.

**Nita Hardwick Ltd.** Private. Reg. Nov. 16. Capital £1,000 in £1 shares. Development, manufacture and marketing of drying equipment for clothes and textiles, etc. Registered office: 12 Bushwood, Leytonstone, E.11.

**Jace Ltd.** Private. Reg. Nov. 17. Capital £5,000 in £1 shares. Manufacturers, bleachers, dyers, printers, finishers and converters of cotton, wool, worsted, cloths, etc. Registered office: Whinney, Smith and Whinney, Midland Bank Buildings, Spring Gardens, Manchester 2.

**Byrom Winding Co. Ltd.** Private. Reg. Nov. 18. Capital £5,000 in £1 shares. Yarn processors. Registered office: Knowl Street Mill, Knowl Street, Stalybridge.

**Colortex Fabrics (Pty.) Ltd.** (F.4841). Particulars filed Nov. 20. Capital: £100,000 in £1 shares. Reg. in Victoria, Australia, Sept. 29, 1947. Dyeing, printing, colouring, bleaching or processing textile goods, etc. British address: 11 Ironmonger Lane, E.C.2.

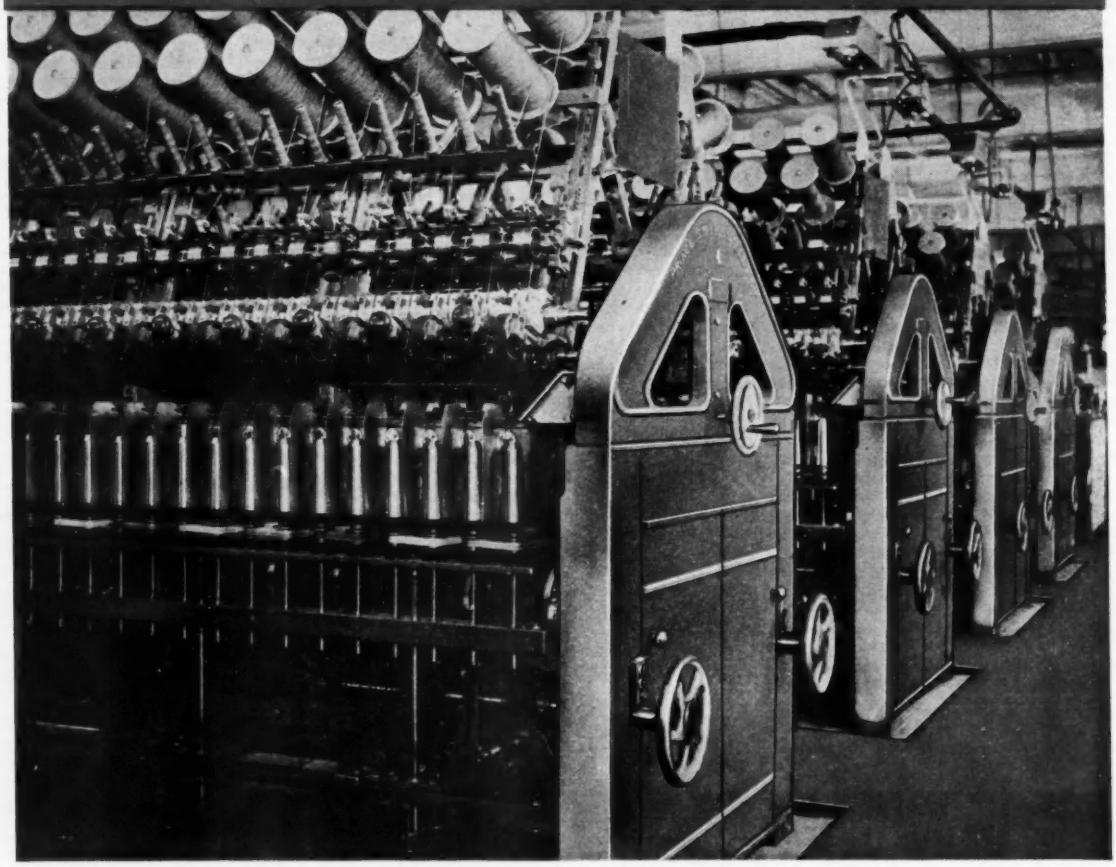
**Griffiths and Johnson Ltd.** Private. Reg. Nov. 20. Capital £1,000 in £1 shares. General engineers, textile machinists, etc. Registered office: Thurston Clough Works, Delph.

**Angus Rhodes and Co. Ltd.** Private. Reg. Aug. 5. Capital £50,000. Wool merchants, combers, spinners, etc. A. H. Rhodes, C. Rhodes, D. Rhodes. Registered office: Springmill Street, Bradford.

**M. and N. Textiles Ltd.** Private. Reg. July 23. Capital £1,000. Cloth manufacturers, etc. N. G. Musry, Mrs. S. Musry. Registered office: China House, 104 Bloom Street, Manchester 1.

# FINE QUALITY WORSTEDS

## are produced on Cap Spinning frames with Ambler Superdraft



*CAP/ASD. installations by courtesy of Messrs. W. E. YATES LTD. BRAMLEY, Nr. Leeds*

***The Economic Advantages of AMBLER SUPERDRAFT are :-***

- Very high draft with consequent reduction in drawing machinery, labour and waste.
- Large supply packages.
- Lower end breakage rate.
- Less spinning and folding twist required, therefore 5% — 10% higher production.

**OVER 100,000 ASD SPINDLES ARE IN OPERATION**

**PRINCE-SMITH & STELLS LTD**

Incorporating TAYLOR WORDSWORTH & CO. LTD.

KEIGHLEY YORKSHIRE ENGLAND

PSS 4

# RECENT TEXTILE PATENTS

These abridgements are republished from specifications by permission of the Controller of H.M. Stationery Office. The full specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2. Price 3s. each.

### 802,513 Improved Rubber Adhesion of Twisted Artificial Fibres

TEXTILE AND CHEMICAL RESEARCH CO. LTD., 6 *Court Row, St. Peter Port, Guernsey.*

A process for the treatment of twisted artificial fibres to reduce internal abrasive wear and to improve its adhesion to rubber materials. The material is impregnated uniformly with a dispersion containing graphite, talc, bentonite or silica as an abrasion-reducing material and is given a surface coating of resorcinol-formaldehyde resin latex as an adhesion promoting agent while under a tension sufficient to bring together the filaments of the material. In one example a rayon cord 1650/2 is impregnated under tension of about 50 g. with a dispersion containing 10 g. of colloidal graphite per litre. Without intermediate drying, a tension of about 750 g. is imparted to the cord which is then passed into an adhesion-promoting bath containing resorcinol-formaldehyde latex. It is then dried and subjected to a temperature of 185°F.

### 803,021 Continuous Bleaching Process

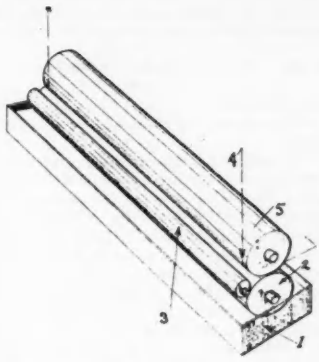
I.C.I. LTD., *London.*

A process for the continuous bleaching of fabrics comprises passing the cloth in open width, through a bath containing trichloroethylene or perchloroethylene, where it is degreased and dewaxed, removing surplus solvent, then passing the cloth through a bath maintained at such a temperature as will flash off the solvent entrained in the cloth. The cloth is then desized by conventional means or subjected to a conventional acid souring treating, followed by padding the cloth in alkaline solution, preferably containing sodium hydroxide such that the bath has a *p*H of at least 10, and optionally containing also a peroxygen compound (in which case the *p*H is preferably controlled in the range 10—12). The padded cloth is heated by passing it into an atmosphere of steam and through a retention device at a temperature of 50 - 105°C. at such a rate as to provide adequate time to effect substantial action of the alkali upon the cloth. Where a full bleach is required and the padding liquor already utilised has not contained sufficient peroxide to achieve this the cloth is rinsed and subsequently padded with a peroxide solution containing 1 to 3 grams per litre of available oxygen and having a *p*H value of 10·0 to 11·0, followed by a further steaming and passage through a retention device at a temperature in the range 50 - 105°C. at such a rate as to provide adequate time for the peroxide to effect a full bleach.

### 803,453 Liquid Treatment of Fabrics

CALICO PRINTERS' ASSOCIATION LTD., *Manchester.*

An improved method of treating materials with liquids, wherein the amount of liquid applied can be controlled at will, while the distribution of the liquid remains

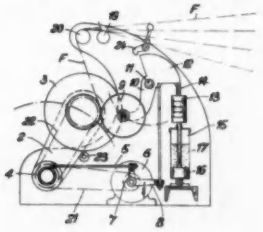



regular. The liquid is contained in a trough 1, and an engraved metal roll 2 is partly immersed in the liquid. A rubber-covered roll 3 is pressed against roll 2 and rotates in contact with it to limit the amount of liquid carried by roll 2 according to the pressure between the rolls. The fabric 4 passes between roll 2 and a rubber-covered roll 5 to which pressure is applied so as to bring the fabric firmly in contact with the charged engraving. Any convenient means may be used for varying the pressure between rolls 3 and 2 and between rolls 5 and 2.

### 803,707 Density Control on Warping Machines

WALTER REINERS, *Peter-Nonnenmühlen-Allee, 54 M. Gladbach, Germany.*

Describes a simple and effective means for controlling the hardness of the winding on a warping machine. The machine comprises a swinging arm 2, which carries a beam 3, and is mounted on a shaft 4. A control rod 5 is connected to the swinging arm and acts through a lever 7 on a regulating gear 6, which controls the winding speed. A second lever 8 forms a bellcrank lever with the lever 7. A compacting roller 9 is mounted on a lever arm 10 which is pivoted on a shaft 11 and balanced by a counterweight 12. The roller 9 can thus swing about the shaft and can be placed under the influence of a set of detachable counterweights 13, arranged on a rod 14. The rod 14 is also attached to a piston 16, which lies in a cylinder 15 containing liquid 17 and acts as a liquid damping device. The group of threads F runs over a comb 19 and a measuring roller 20



on to the beam, and the drive to the beam is effected through chains 21 and 22. A stop 23 is provided to limit the clockwise movement of the arm 2, while the roller 9 can be fixed in its extreme leftward position by a latch 24 engaging part of the counterweight 12. If the beam is to be wound hard, latch 24 is engaged thus fixing the compacting roller and as the beam fills it moves to the left, owing to its increasing diameter, and lifts off the stop 23. If a soft wound beam is required the latch 24 is released, and the arm 2 is located on the stop 23 by the weight of the beam. The roller 9 then moves away from the beam always exerting a pressure as determined by the set of counterweights 13. This pressure will generally be considerably less than that provided by the full weight of the beam acting on the fixed compacting roller. When winding a hard beam the beam drive is also varied in accordance with the fullness of the beam by adjustment of the winding gear 6 through the lever 7. The lever 7 being attached to the arm 2 is caused to follow the swinging movement of the beam and provides the adjustment automatically.

### 803,831 Clamping Flange on Warp, etc. Beams

THOMAS ASHWORTH AND CO. LTD., *Vulcan Works, Rosegrove, Burnley.*

In B.P. 663,644 there is described a method of clamping a flange to a barrel of a warp beam, in which a lever or each of several is formed with two bearing points one of which is caused to bear on the barrel and the other on an abutment on the flange, by imparting a turning moment to the lever by means of a bolt. The lever is now constructed to be resilient and for this purpose, the lever may be constructed from a strip of metal bent so that one end can be engaged with an abutment on the flange, the other end can be engaged by the bolt, and an intermediate part can serve as a bearing point for engagement with the barrel. The strip may also be given a wavy formation so as to increase its resilience.

### 804,150 Bobbin Containers on Automatic Winders

MASCHINENFABRIK SCHWEITER A.-G., *Horgen, Switzerland*

An improvement of the container for collecting wound bobbins and in conjunction with an automatic winder, means for introducing the bobbins into the container, as claimed in B.P. No. 751,995. The container is a magazine having flat sides and on the bracket of the automatic winder there is mounted a travelling support which accommodates the magazine and has means for accommodating a number of weft bobbin magazines arranged upright in successive order with their flat sides disposed one against the other, with the object of successively locating each magazine over the magazine filling point. The travelling support is movable

step by step by an amount equal to the spacing of the centres of a pair of weft bobbin magazines on the support.

### 804,160 Asbestos Fibre Paper

AMERICAN CYANAMID CO., 30 *Rockefeller Plaza, New York, U.S.A.*

A water-laid web is composed of asbestos fibres bonded together with between 0·01% and 5% based on their weight, of a uniformly distributed content of a normally water-dispersible linear carbon chain polymer carrying carboxylic and amide groups in ratio between about 3 : 97 and 40 : 60, or a polyvalent metal salt of the polymer. The ratio of the total number of carboxyl groups and amide groups to the total number of linear carbon atoms in the polymer is between about 1 : 4 and 3 : 4.

### 804,224 Frame Construction on Doubling, Twisting, etc. Machines

T.M.M. (RESEARCH) LTD., *Hartford Works, Oldham.*

An improved manner of construction of skeletal structure for spinnin g,doubling, twisting, and similar machines. The structure comprises transversely disposed vertical frames respectively located at the ends of the structure. At spaced intermediate points each adjacent pair of vertical frames are connected at one or more levels to longitudinal members by single transverse pins passed through apertured parts of the frames to the longitudinal members.

### 804,264 Coloured Laminated Fabrics

COURTAULDS LTD., 16 *St. Martin's-le-Grand, London.*

The object is to produce fused fabric assemblies having no difference in shade from the original fabric. The coloured fused fabric is formed by applying heat and pressure, to an assembly of a ply of a fusible interlining containing polythene threads and at least one ply of a coloured fabric. The polythene threads are spun-dyed threads of a colour and shade matching or nearly matching the colour and shade of the fabric to be fused.

### 804,267 Reed Construction on Wire Looms

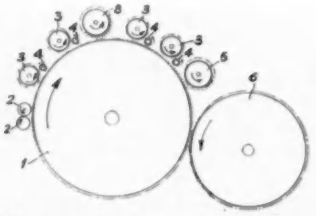
K. U. SCHUSTER, *Giengen an der Brenz, Baden-Wurttemberg, German Federal Republic.*

A reed for looms for weaving metal gauze or fabric includes dents, each having a transverse notch, the notches together forming a slot extending along the entire reed. The inner edge of each of the notches, serves as a beating edge, and the depth of each of the notches is at least equal to the combined diameters of two weft wires and one warp wire of the fabric. One of the edges defines the slot in each of the dents extending in the weaving direction when the dent is in the beating position, and forms a contact surface for the fabric.

### 804,338 Roller and Clearer Cards

R. P. H. J. FABRE, *Roquecourbe (Tarn) France.*

A worker carding machine comprises, in combination with the large cylinder, pairs of worker and stripper rollers in which the stripper is disposed after the worker in the direction of travel of the material and, in addition to the usual final fancy, a supplementary fancy or fancies interposed between the pairs of workers and strippers. In the embodiment illustrated, the material meets successively a group of two pairs of

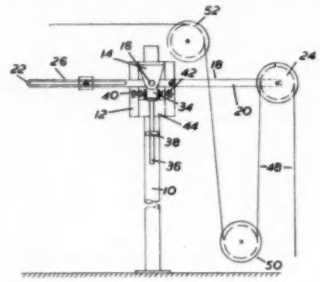


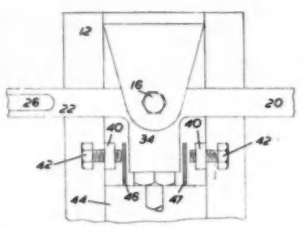
workers 3 and strippers 4, an additional fancy 8, two other pairs of workers and strippers 3, 4, a fancy 5 and the doffer 6.

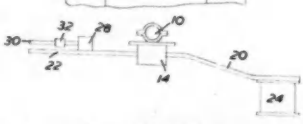
### 804,581 Sliver Fault Detection on Cards

ALLEN PRIEST AND SONS LTD., *Bath Mills, Albert Street, Lockwood, near Huddersfield.*

A silver fault detecting device applicable to carding engines for use with all types of fibres. A pillar 10 is mounted adjacent one side of a Scotch feed device and has mounted on it a bracket 12. Supported on the bracket is a member 14, having a pivot 16. Mounted on the pivot is a balance arm 18 which has extending from it two arms 20 and 22. The arm 20 is cranked and is adapted to support a roller 24, whilst arm 22 has formed in it a slot 26 which supports an adjustable balance weight. The weight comprises a main weight 28 which is retained on the arm 22, and extending from the main weight is a rod 30 which has a secondary weight 32. Also on the arm 18 is a boss 34 which has a pendulum 36. Mounted on the pendulum is a weight 38. Formed on the pivot







member are lugs 40 which support adjustable stops 42, also mounted on the member is a contact box 44 which has extending from it two sets of contacts 46 and 47. A relay from the contact box extends to a warning device (not shown) which employs both electric lamps and hooter. When the device is in operation a sliver 48 from a scribbler is passed over roller 24, under roller 50 and over a top roller 52 from where it is traversed to a feeding device. As the sliver passes over roller 24 the weight of the sliver on the roller is the weight of the sliver between where it leaves the scribbler and where it engages the roller 50 plus the tension in the sliver which is a weight over a uniform length of sliver. When the weight of unit length of the sliver has been determined, the adjustable balance weight on arm 20 is set in such a position that any increase or decrease of weight of the sliver causes the balance arm 18 to rock in one direction or the other which operates the warning device.

### 804,698 Mail and Lingoe Connection on Jacquards

SAMUEL DRACUP AND SONS LTD., *Lane Close Mills, Great Horton, Bradford.*

Describes a new connection between a wire mail and a lingoe for a jacquard machine. The connection between the lower end of a wire mail and a lingoe is made rigid. With such a connection, lateral or swinging movements of the lingoe relatively to the mail cannot take place about the connection. Consequently the mail will always be correctly aligned with the lingoe and projections liable to foul adjacent connections or wire mails are eliminated or reduced.

### 804,792 Tag-End Formation on Jute Spinning Frames

JAMES MACKIE AND SONS LTD., *Albert Foundry, Belfast, Ireland.*

Tag end forming means, in which each bobbin, for receiving the wound-back yarn has an endless groove in its lower flange. For retaining the yarn in the groove, a shroud is provided which surrounds the lower flange and, without being fixed to the bobbin, rotates with it and which is bounded at the top by an edge which lies in the path of the yarn during the winding-back and is formed as to allow an indefinite number of turns of yarn to be wound on the groove.

### 804,825 Creel Bobbin Holders

LUWA AG., 40 *Anemonenstrasse, Zürich, Switzerland.*

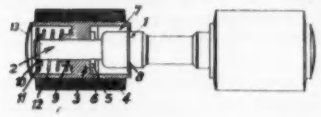
A bobbin holder for supporting bobbins in the creels of spinning or roving frames. The holder has a connecting member for engagement with a carrier rail, and a supporting member mounted in the connecting member and carrying resilient means at the unpivoted end for engagement with a bobbin. The connecting member comprises an apertured socket in which a hemispherical bearing member is arranged and a connecting bolt guided in a bore in the bearing member and secured against axial displacement in at least one direction. The supporting member is attached to the connecting bolt for rotation with it.

### 804,843 Removing Dust, etc. from Drafting Rollers

SKF KUGELLAGERFABRIKEN GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, 13 *Ernst Sachs Strasse, Schweinfurt am Main, Germany.*

Improvements in drafting rollers to facilitate the removal of dust and fluff from the neighbourhood of the roller bearing. The roller shaft 2 rotatable in the stationary housing 1 has a drafting member at each end. Each member comprises a shell 3, which has a covering 4, and is a sliding fit on the shaft. A pin 5, which reaches through the shaft, engages a groove 6 in

the shell so that the shell is restrained against rotation relatively to the shaft. The pin 5 also operates to limit movement of the shell 3 in the direction towards the remote end of the roller. The space 7 between the housing of the bearing and the shell is almost completely closed by a disc 8 on the housing, but this disc does not



prevent all dust and fluff from entering the space 7. For the purpose of retaining the shell in operative position and for returning it into this position after cleaning, a spring 12 is positioned between a boss-shaped portion 9 and a pressure plate 11, the latter being retained on the shaft by a spring ring 10 which can, if necessary, be removed. In order to prevent dust from entering the part of the shell in which the spring 12 is situated, a cover plate 13 is mounted on the shell.

### 804,781 Anti-Felting Treatment for Wool

WOOL INDUSTRIES RESEARCH ASSOCIATION, *Torridon, Leeds.*

Treatment of wool or materials containing wool so that the materials have a reduced tendency to felt. The wool-containing goods are treated with a dilute solution of an organic per-acid of the general formula R.CO.O.OH (where R = hydrogen or an alkyl group) preferably containing an anionic wetting agent and, after rinsing in water, are treated with a protease, from either a vegetable or animal source, in the presence of compounds that enhances the reaction between the wool and protease. In one example, 100 parts of scoured hosiery fabric made from 64s quality wool were treated in 3,000 parts of a solution containing 12 parts of peracetic acid and 3 parts of an anionic wetting agent at 30°C. for 1 minute. After rinsing in water at 30°C. the fabric was treated with 3,000 parts of a solution containing 0.3 parts of vegetable protease papain, 30 parts of sodium bisulphite (the pure iron-free anhydrous powder), 3·75 parts of sodium carbonate (anhydrous) at a *p*H of 6·7 and a temperature of 50°C. for 30 minutes. The fabric was then rinsed for 15 minutes with cold water (15°C.) and then 5 minutes with warm water (40°C.).

### 804,952 Sizing Compositions

ROHM AND HAAS CO., 222 *West Washington Square, Philadelphia, Pennsylvania, U.S.A.*

Relates to sized textiles and the sizing or dressing of fibres, filaments, and yarns. It is particularly concerned with sizes of removable type applied to hydrophobic artificial filaments and fibres, such as nylon. In one example, a solution containing 17·5% of a water-dispersible ethylene oxide-modified starch (containing about 3% oxyethylene units based on the weight of starch and available under the trade name Penford Gum 260), 0·9% of a lubricant in the form of a solubilised tallow (sulphonated), and 4% of the ammonium salt of a copolymer of 20 mole per cent. acrylic acid and 80 mole per cent. ethyl acrylate, having a Knoop hardness of 1, was placed in the size box of a slasher. A warp of 100% spun nylon yarn, 16·5 cotton count, single ply, 18·2 turns "Z" twist per inch was passed through the slasher and dried on the drying cans thereof at 190 to 210°F. No sizing material stuck to the cans. The size exhibited excellent adhesion to the yarns and very good fibre lay. The warp (containing 17% size on the initial weight of fabric) was then woven into a plain weave industrial fabric (44 × 44) without appreciable breakage of yarns or transfer of size to the shuttles. The size was readily removed on scouring. In another example a solution containing 18% of the modified starch of Example 1 and 4·6% of the ammonium salt the copolymer of 20 mole per cent. acrylic acid and 80 mole per cent. ethyl acrylate, was introduced into the size box. A warp of a spun yarn of a copolymer of about 90% acrylonitrile ("Acrilan") 30 cotton count, single ply was passed through the slasher and dried on the cans thereof at 180°F. No sizing was retained on the cans. The size exhibited excellent adhesion to the yarns and very good fibre lay. The warp was then woven into a plain weave fabric without appreciable breakage yarn or transfer of size to the shuttles. The size was readily removed on scouring.

### 805,212 Balloon Control in Twisting, etc.

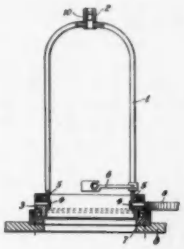
A. W. VIBBER, 120 *South Irving Street, Ridgewood, New Jersey, U.S.A.*

Apparatus for twisting and doubling machines for detecting variations in the size or shape of the balloon is positioned inwardly of such balloon and engages the inner surface of the balloon. The detecting apparatus may thus be located adjacent the variable yarn tensioning means to be controlled, and both the detecting means and the controlling means are located within the balloon, so that simple and direct operating connections may be employed between the balloon size detecting and the balloon size varying means.

### 805,267 Ball-Bearing Flyer

VEB SPINNEREIMASCHINENBAU, *Karl-Marx-Stadt, 27 Altchemnitzer Strasse, Karl-Marx-Stadt, Germany.*

Improved flyers for spinning frames in which the lower part of the flyer is mounted in a ball race. At the top of the flyer 1 is a yarn insertion socket 2, and the flyer 1 is carried by a ball race 3, to which it is hinged by its two free ends. For this purpose the ball race has, at two diametrically opposite points, bolts 4 on which the free ends of the flyer are loosely pivoted. The flyer can thus be turned about an axis which is at right angles to its axis of rotation and in working position it is resiliently secured by means of a spring-loaded detent 5. The ball race rests on anti-friction bearings in a fixed ring 7 of a spindle bearing plate 8. The flyer is driven either by the tension of the thread or by a friction disc 9 acting directly on the ball race. The yarn is inserted into the socket 2 from above and taken through a hole 10 to the leg carrying the guide 6, and from here through the guide 6 to the bobbin. When the bobbin is full it is only necessary to swing the flyer at right angles about the hinge bolts 4 whereupon the full bobbin can readily be removed and replaced by an empty one.

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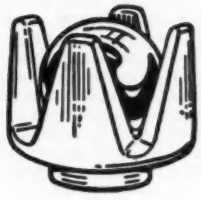

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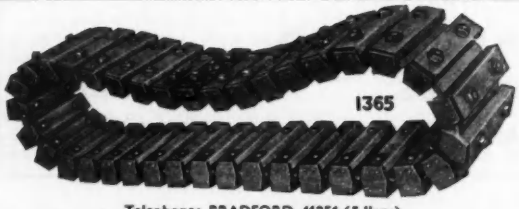


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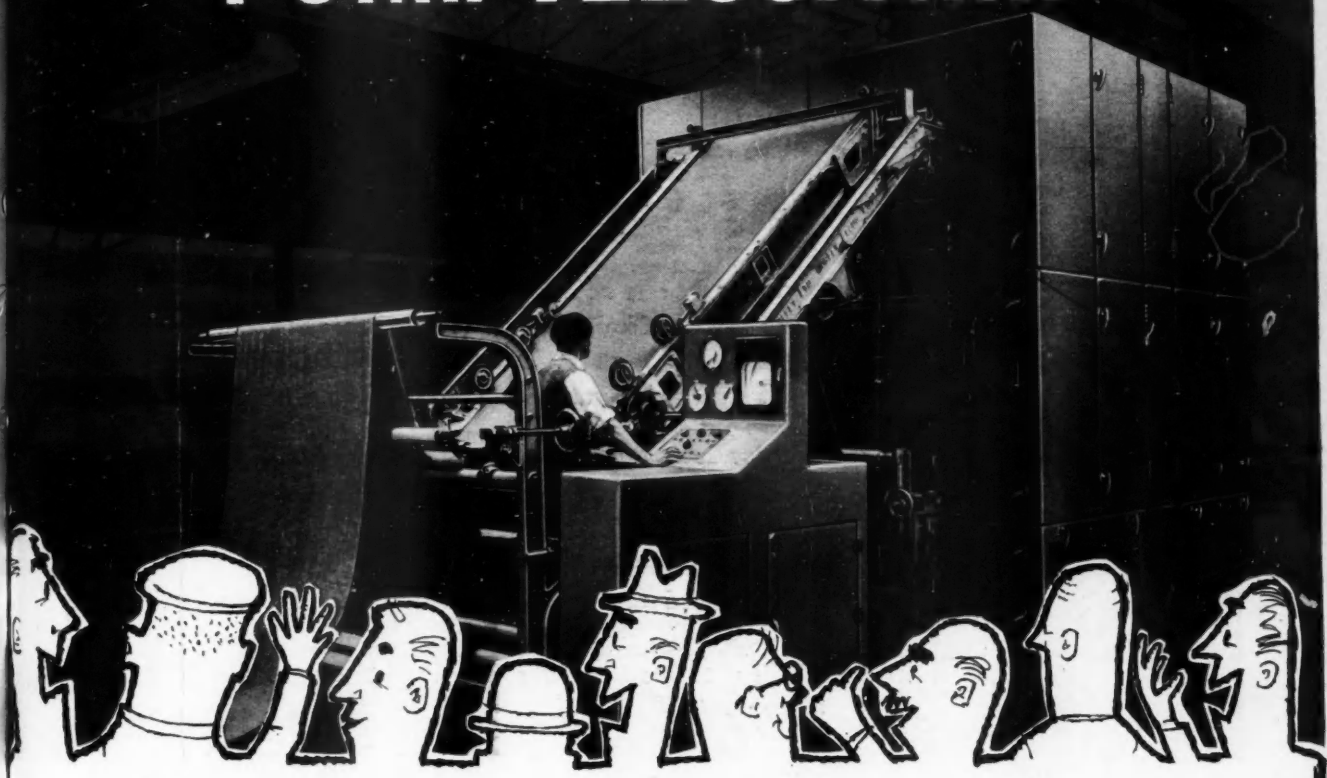

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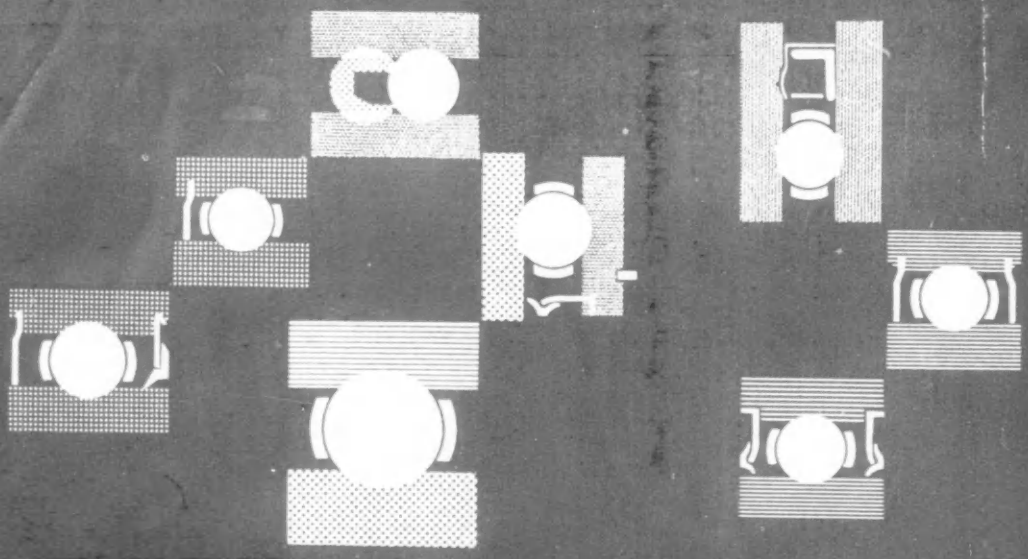

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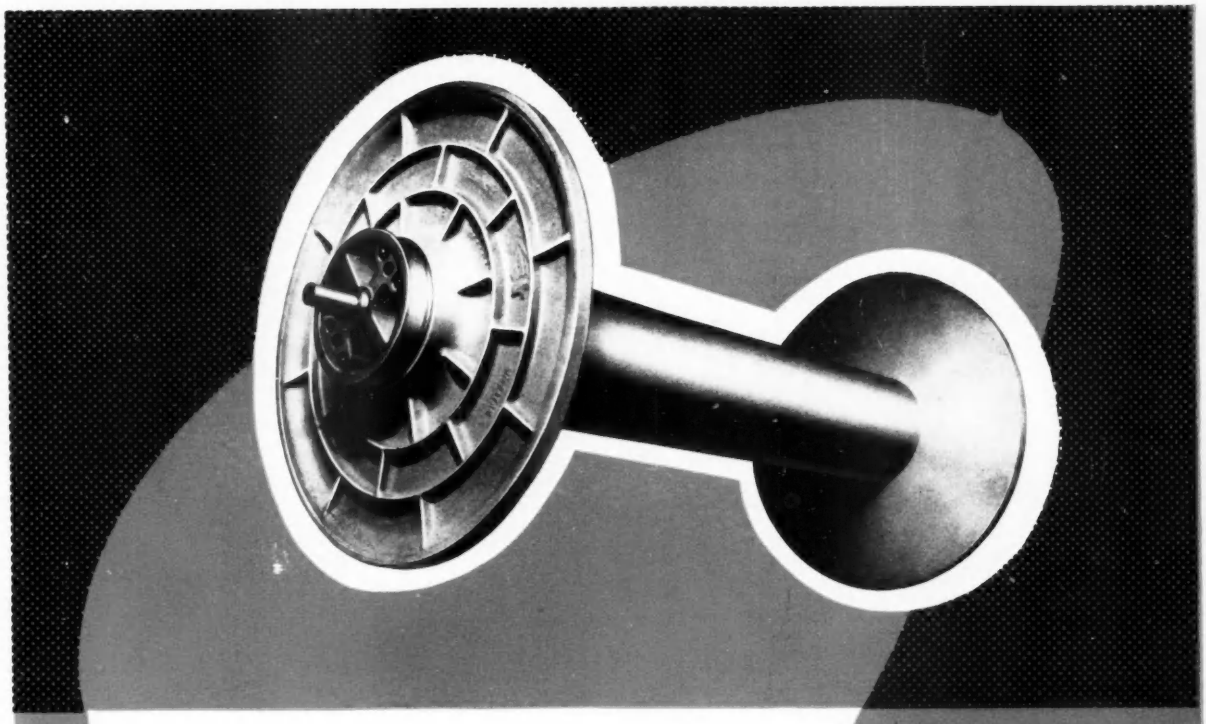

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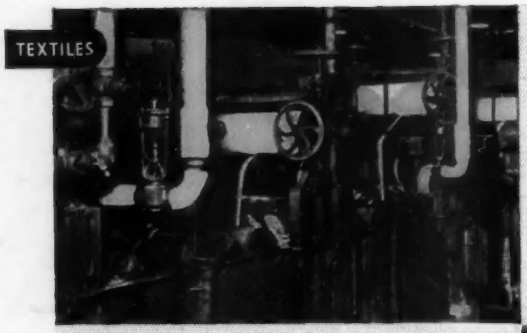


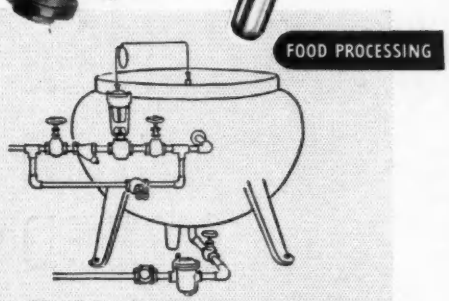


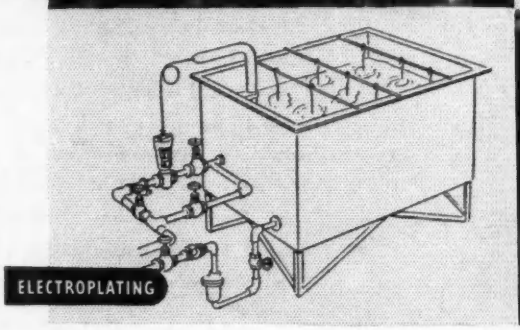


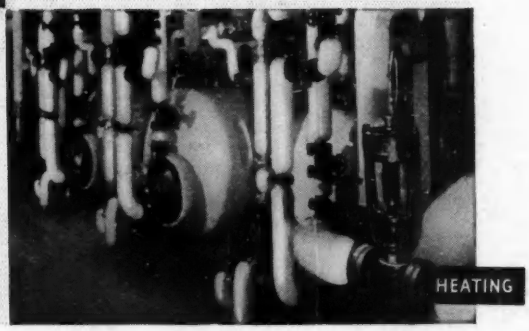


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